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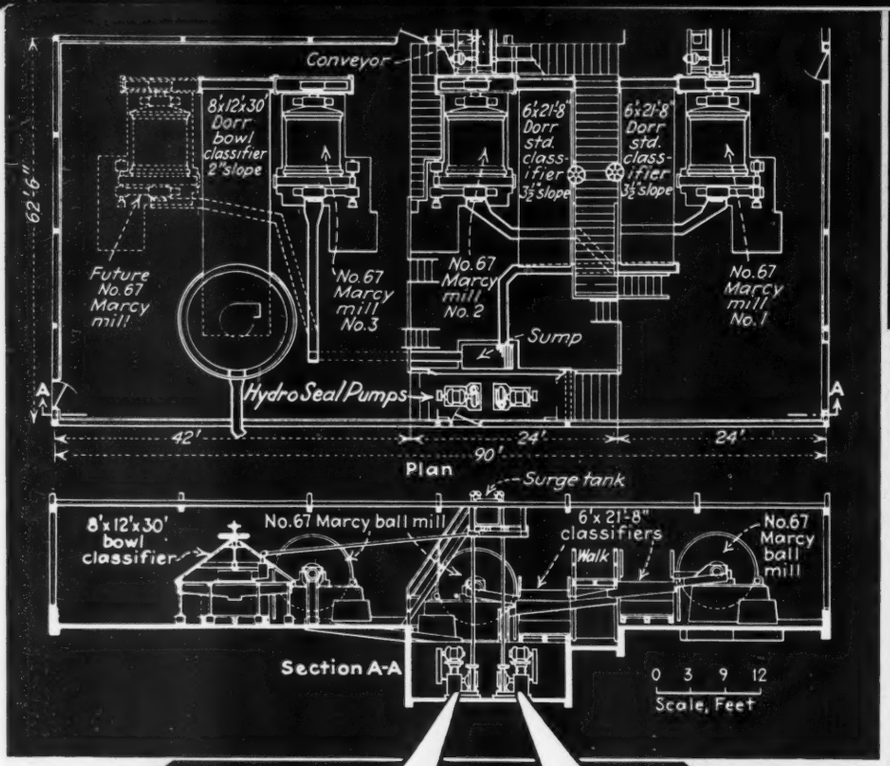

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The Government paid an average of 9.5c. more per fine ounce of silver than the average New York open-market price during the fiscal year 1936, according to the Annual Report of the Director of the Mint. Acquisitions of silver totaled 609,613,258 fine ounces, at a total cost of $395,313,736, an average of 64.8c. per fine ounce. The open-market price in New York averaged 55.34c. The highest point on the open market was 70.062c., July 1, 1935; the lowest was 45.062c., Jan. 20, 1936, a price maintained almost continuously the rest of the year.

▼

Blasting Accidents have figured prominently in recent news. One of serious degree, causing many fatalities, occurred in a South American mine. Another happened in the course of highway construction in Mexico. Carelessness can produce them anywhere. Thomas Soule, chief engineer of the Industrial Indemnity Exchange, of San Francisco, and W. J. Williams, safety engineer for the Phelps Dodge Corporation at Morenci, have analyzed eighteen typical mishaps and made recommendations as to avoiding them. Their views will be presented next month.

▼

Burying Gold. The first shipment of gold bullion from the Philadelphia Mint has been received at the armored Depository at Fort Knox, Kentucky. Post Office inspectors, soldiers, Bureau of the Mint guards, and Secret Service men joined in safeguarding the bullion as it was transported by truck and special train. Still and motion pictures of the event were taken by permission of the Treasury. The vault at Fort Knox is 40 x 60 ft. and has a casing 25 in. thick. The door weighs more than 20 tons and the roof is independent of the bomb-proof Depository roof.

▼

Gold-Recovery practice has turned the clock back a bit in some respects. More stress is laid today on certain methods that seemed on the wane a quarter-century ago. M. W. von Bernewitz will review these trends next month.

H. C. PARMELEE
Editorial Director

Engineering and Mining Journal

A. W. FISHER
Manager

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Vice-President

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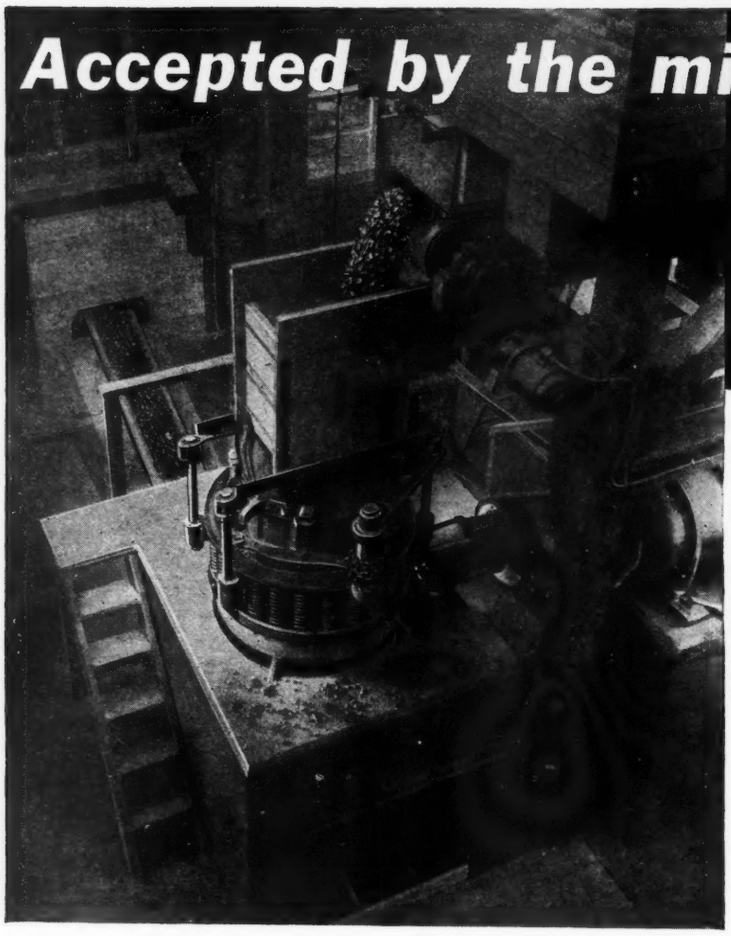

Another Canadian Gold Installation

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Volume 138 Number 2

FEBRUARY 1937

The Trend is UPWARD

FOR BACKGROUND to this comment we reproduce *Business Week's* index of business activity since 1929. Ignoring details, the drop was precipitous from 1929 to early 1933, when the tide turned. Since then the trend has been steadily upward.

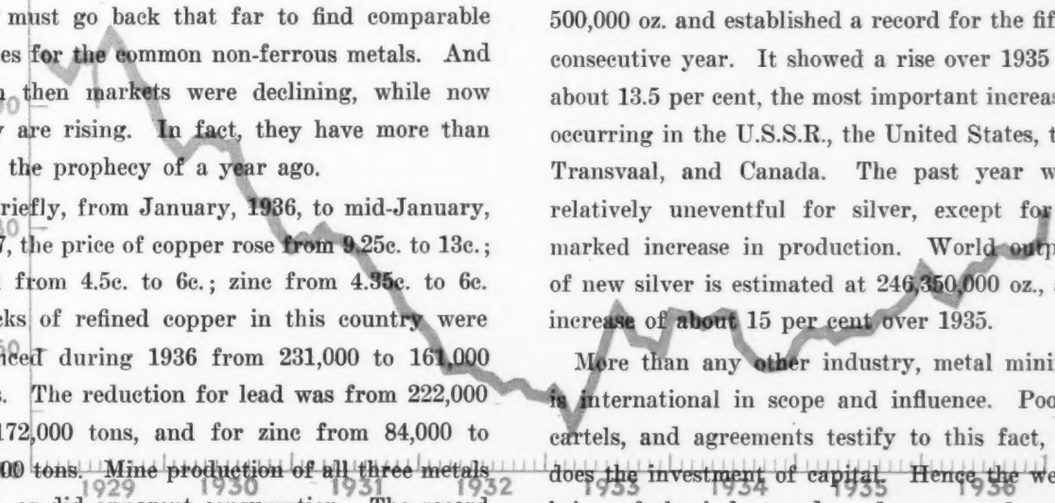
Metal mining has shared this trend. In 1936 it enjoyed the best year since 1930. At least one must go back that far to find comparable prices for the common non-ferrous metals. And even then markets were declining, while now they are rising. In fact, they have more than met the prophecy of a year ago.

Briefly, from January, 1936, to mid-January, 1937, the price of copper rose from 9.25c. to 13c.; lead from 4.5c. to 6c.; zinc from 4.35c. to 6c. Stocks of refined copper in this country were reduced during 1936 from 231,000 to 161,000 tons. The reduction for lead was from 222,000 to 172,000 tons, and for zinc from 84,000 to 45,000 tons. Mine production of all three metals rose, as did apparent consumption. The record is in marked contrast to that of the dark days of 1932-33.

Nevertheless, the reader will observe in the following pages that our authorities do not regard recent market developments as unmixed blessings. They contain too much of the element of a speculative boom. Engineered in London, it has had its inevitable effect in the United States, and has introduced a factor of uncertainty and confusion in an otherwise orderly metal market. However, the trend of business activity is upward, and the prospect for 1937 is that the momentum and persistence of recovery, particularly in the capital-goods industries, will withstand the unfavorable impact of commodity speculation and probable labor disturbances.

World gold production in 1936 rose to 35,500,000 oz. and established a record for the fifth consecutive year. It showed a rise over 1935 of about 13.5 per cent, the most important increases occurring in the U.S.S.R., the United States, the Transvaal, and Canada. The past year was relatively uneventful for silver, except for a marked increase in production. World output of new silver is estimated at 246,350,000 oz., an increase of about 15 per cent over 1935.

More than any other industry, metal mining is international in scope and influence. Pools, cartels, and agreements testify to this fact, as does the investment of capital. Hence the well-being of the industry depends more and more on the play of international forces. The present outlook, barring the catastrophe of war, which observers are inclined to agree is not imminent, is for a prosperous year in mining throughout the world.



GOLD

World output 13½ per cent higher. Credit inflation controls expected to curb domestic costs

H. N. Lawrie[1]
Consulting Economist
Washington, D. C.

THE fifth consecutive record world's gold production was established in 1936, amounting to 35,531,000 fine ounces, as compared to 31,280,680 ounces in 1935, an increase of 4,250,320 ounces, or 13.5 per cent. Excluding the output increases of the U.S.S.R. in both 1935 and 1936, the increase for the rest of the world in 1936 was about 1,100,000 ounces greater than the increase in 1935, reflecting the additional output contributed in 1936 from the new dredging and milling equipment recently installed, and from which we may expect to realize a sixth record world gold production in 1937. Table I, comparing the ouputs by countries for 1935 and 1936, reveals no declines and that the most important increases took place in Russia and Siberia, the United States, the Transvaal, and Canada.

Production of gold in the United States in 1936 amounted to 3,713,187 ounces and, including the Philippines and Puerto Rico, to 4,313,122 ounces, an increase of 766,953 ounces, or 21.6 per cent, and higher than the increase ratio of world output by 8 per cent. In 1936 California maintained its first position, South Dakota second, and Alaska third. Major increases were California, 185,552 ounces; Nevada, 119,957 ounces; Arizona, 96,363 ounces; Alaska, 56,756 ounces; and Utah, 44,366 ounces. Table II, comparing the 1935 and 1936 outputs by States, shows that the Philippine output increased 168,798 ounces.

Gold imports into the United States in 1936 amounted to $1,144,117,000 and exports to $27,534,000, a net inflow of $1,116,583,000, as compared with a net inflow of $1,739,018,796 in 1935, a decline in 1936 of $622,435,796, or more than 35 per cent. As in 1935 most of the gold was shipped here from Europe and the maldistribution of monetary gold was further accentuated. The uncertainty of war and the attractiveness of American securities were the principal reasons for such heavy European gold shipments. More of the gold previously hoarded in private accounts was released and became a part of the world's monetary gold stock, which is decidedly favorable despite the disadvantages of a more extreme disequilibrium in monetary gold distribution. Gold imports early in 1936 became smaller, and it was thought that a reversal of the gold movement might be in sight, but gold devaluation by France late in September resulted in the continuance of heavy exports of gold from Europe. This once again gave rise to the problem of excessive gold reserves and the danger of inflation.

Will the costs of gold production greatly increase in 1937? The Administration has declared its objective to permit commodity prices gradually to rise to pre-depression levels in order to stimulate employment and to prevent an extensive inflationary rise in prices. In making this objective effective, a low-cost credit policy will probably be maintained and the Secretary of the Treasury and the Chairman of the Federal Reserve Board have enumerated the following credit and currency inflation controls:

1. A billion and a half dollars of the then excessive monetary gold reserve was "sterilized" on Aug. 15, 1936, when the Federal Reserve Board increased gold reserve requirements 50 per cent and the Board on Jan. 30, 1937, announced a further increase in such requirements of 50 per cent, half of which is to become effective March 1, 1937, and half on May 1, 1937, thereby sterilizing another billion and a half dollars of the currently excessive gold reserve. The total increase of 100 per cent in gold reserve requirements will reduce the possible volume of credit from 36 to 3 billion dollars, a most effective and desirable check on excessive inflation.

2. Announcement was made on Dec. 22, 1936, that Treasury bills would be sold and that the funds so derived would be used to purchase all gold imported, domestically produced, or recovered from the industrial arts, the same to be placed in an "Inactive Account." In this way the already excessive monetary gold reserve will be protected from further expansion and from becoming an increasing base for an undesirable volume of credit and currency.

3. The Federal Reserve banks own about $2,470,000,000 of Government securities which can be sold and thus correspondingly reduce the credit base, and it is the intention to use this

Table I
WORLD GOLD PRODUCTION
In Fine Ounces

	(a)1935	(a)1936
North America		
United States	3,115,514	3,713,000
Canada	3,280,457	3,738,000
Mexico	682,257	782,000
Newfoundland	12,000	12,000
Totals	7,090,228	8,245,000
Central America	150,000	170,000
South America	1,321,000	1,500,000
Europe		
Russia and Siberia	(b)5,831,106	(c)7,289,000
Other Europe	771,000	850,000
Totals	6,602,106	8,139,000
Asia		
British India	324,816	330,000
East Indies	63,000	65,000
Japan and Korea	871,000	958,000
Philippines	430,655	600,000
China and others	348,000	383,000
Totals	2,032,471	2,336,000
Oceania		
Australia	890,214	1,099,000
Fiji	2,000	3,000
Tasmania	8,342	9,000
New Guinea	275,000	315,000
Papua	7,000	9,000
New Zealand	168,312	183,000
Totals	1,350,868	1,618,000
Africa		
Transvaal	10,776,684	11,339,000
Rhodesia	728,280	803,000
West Africa	395,743	523,000
Congo, Egypt, etc.	833,300	858,000
Totals	12,734,007	13,523,000
Totals for world	31,280,680	35,531,000
Total value in 1935 ($35=1 oz.)	$1,094,823,800	
Total value in 1936 ($35=1 oz.)		$1,243,585,000

(a) Data for 1935 revised to date and 1936 estimates based largely on ten months' production, by H. N. Lawrie.
(b) Based on Soviet press reports and probably includes 500,000 oz. recovered from ores, concentrates, etc., sent to the United States for refining in 1935.
(c) Based on Soviet press reports and probably includes 300,000 oz. recovered from ores, concentrates, etc., sent to the United States for refining in 1936.

[1] Formerly Economic Adviser to the United States Senate Commission of Gold and Silver Inquiry and author since 1928 of the Chapter on Gold and Silver in "The Mineral Industry."

Table II—Production of Gold in the United States

In Fine Ounces

	1935*	1936*
Alaska	454,226	510,982
Alabama	1,965	4,923
Arizona	218,921	315,284
California	857,363	1,042,915
Colorado	348,914	364,852
Georgia	1,004	398
Idaho	81,264	82,289
Maryland	.....	596
Montana	134,501	179,768
Nevada	165,812	285,769
New Mexico...	31,085	33,312
North Carolina	2,175	1,807
Oklahoma	.....	2
Oregon	51,255	59,765
Pennsylvania ..	845	1,114
South Carolina	703	474
South Dakota..	569,222	589,229
Tennessee	623	190
Texas	493	593
Utah	181,049	225,415
Virginia	150	748
Washington ...	10,091	10,816
Wyoming	3,789	1,946
Totals	3,115,450	3,713,187
Philippines	430,655	599,453
Puerto Rico...	64	482
Totals	3,546,169	4,313,122
Value (a)	$124,115,915	$150,959,270
Record Year 1915	4,887,604 oz.	
Value	(b)$101,035,700	

* Compiled by H. N. Lawrie from data issued by the Bureau of the Mint, with the cooperation of the Bureau of Mines.
(*a*) Value on the basis of $35 per fine ounce of gold.
(*b*) Value on the basis of $20.6718 per fine ounce of gold.

control should the occasion arise where it would be necessary to check an undue credit inflation.

The Secretary of the Treasury and the Chairman of the Federal Reserve Board have expressed the view that these credit inflation controls are sufficient and that it will not be necessary to go to Congress for further authority. With this assurance, and providing that these inflation controls are rigorously applied, gold-mining operators will probably not be confronted by greatly increased production costs in 1937.

Since the depression began, one of the most constructive steps was taken on Sept. 25, 1936, when the currency stabilization accord between the United States, Great Britain, and France was announced. The desirable results of this united effort to bring order out of chaos have been materially to lessen the range of fluctuations in the dollar, pound, and franc exchanges and to permit the reduction or removal of trade barriers and exchange restrictions. The announcement was made on Nov. 23, 1936, that Belgium, Switzerland, and The Netherlands had been admitted to the tripartite monetary agreement. During 1937 other nations may also desire to qualify for admission to the currency stabilization group. The more nations that participate, the more effective the result should become, with lightened burdens for each of the participating nations to bear. The international flow of trade and capital has already reflected the benefits of this tentative and informal currency stabilization movement. Though world economic recovery probably has not advanced sufficiently to permit nations successfully to consider the question of *de jure* currency stabilization and the adoption of a modernized form of the gold standard at this time, it is to be hoped that during 1937 much progress will be made toward that much to be desired end.

Had it not been for the Act of Congress, signed by the President on Jan. 25, 1937, extending the "Dollar Stabilization Fund," of $2,000,000,000, the United States could not have continued its currency stabilization agreements with Great Britain and France beyond Jan. 30, 1937, the date upon which the original act expired. This timely action was taken because the Administration realizes the necessity for world currency stabilization as an essential to the restoration of normal international trade.

Until the monetary status of gold is definitely determined and gold is again integrated in a world monetary system, the market price for gold will remain uncertain. It seems more definite now that the world trend is toward the ultimate adoption of some modernized form of gold standard, sufficiently flexible to meet the domestic requirements of nations for currency and credit and to maintain the essential degree of international currency stability.

It should be pointed out that all six of the nations now participating in the currency accord have reserved the right to change the value of their currencies and to withdraw from the accord on short notice. The Act of Congress extending the "Dollar Stabilization Fund" to June 30, 1939, also extends the Executive authority further to reduce the gold content of the dollar down to 50 per cent of the old gold standard par. Consequently it is too early to forecast what the price of gold or the world price level may be, when a modernized form of the gold standard is under consideration for final adoption. The equation of gold prices and gold production costs will probably remain open on both sides until normal economic conditions are re-established.

Henceforth, the gold mining industry must meet with keener competition for capital, not only because other industries are regaining larger earning

(Continued on page 56)

SILVER

Production of metal nears 1929 peak. Chinese monetary demand off. India again buys ornaments

Dickson H. Leavens
Cowles Commission for Research in Economics

FOR SILVER the year 1936 was one of the most uneventful of any since the beginning of the depression, and, as a result, the metal has occupied little space in the world's news. On Jan. 2 a year ago the price of silver, at the year's high, was 49¾c. per ounce; by Jan. 20 it had fallen to 44¾c. the year's low. It remained pegged at that point, except for a rise of a cent for a few days in May, until after the elections in November, when it rose to 47½c. for a few days and fluctuated in the neighborhood of 46c. for the remainder of the year. The average for the year was close to 45c., which, with gold at $35 per ounce, represented a gold-silver ratio of 78 to 1, or close to the all-time low value of silver in terms of gold. American producers, of course, have continued to sell their silver to the Treasury at 77.57c. per ounce, or the equivalent of a 45 to 1 ratio, still a long way from the silver bloc's goal of 16 to 1.

Production of silver, in spite of the low price, has increased greatly throughout the world, as shown by the accompanying table. At 246,350,000 fine ounces, world production is not far from the 1929 peak of 261,000,000 fine ounces.

In addition to new production, the market has been supplied with a large quantity of silver from China. That country has carried out successfully its program of managed currency initiated on Nov. 4, 1935. Although the Government has not been as successful in calling in silver as was the American Government in getting possession of gold, it has made the use of bank notes almost universal in circulation. Silver has been driven into hiding, from which it gradually flows out to the Chinese Government banks, as confidence in the note issue grows. From the bank reserves, the Government exported during the year over 160,000,000 fine ounces. The greater part of

this came to the United States, where a Chinese mission negotiated a sale to the Treasury. There is little likelihood that the present Chinese Government will revert to the silver standard or to any extensive use of the white metal for monetary purposes. Its managed currency system requires, instead, the accumulation of earmarked gold and foreign exchange. There is at least 1,000,000,000 oz. of monetary silver in China, the greater part of which is not yet under the control of the Government banks. This great stock is likely to come on the world market in considerable annual installments for the next few years, unless political conditions in China should encourage continued hoarding.

The position of India, the other great traditional user of silver, is very different. India takes no new silver for monetary purposes; in fact, the Government for nearly a decade has been disposing of silver derived from melted rupee coins at an average rate of nearly 30,000,000 fine ounces per year. It is likely to continue to do so for some years to come, for surplus rupees are piling up in the Reserve Bank of India at the rate of about 40,000,000 fine ounces per year. The Indian people, however, still retain their age-long habit of buying silver ornaments for their womenfolk. During the depression, the Indian farmer had no cash to invest in this way, and even when the prices of his products began to rise, the price of silver in 1935 was too high for him. In 1936, however, the price of silver in terms of rupees has been at practically the lowest level ever reached in India, and the India farmer began to buy again. India's imports of silver for the year were in the neighborhood of 100,000,000 fine ounces, comparable to pre-depression figures. Part of this undoubtedly represents the accumulation of demand unsatisfied during the lean years, but it seems probable that India may be counted on to absorb considerable quantities each year if the price remains low and if the world prices of agricultural exports are high enough to give the farmer a surplus.

The American Treasury has remained the world's chief buyer of silver. When the Silver Purchase Act was passed in June, 1934, the quota to be purchased in order to bring the monetary stock of silver up to one-third the monetary stock of gold was about 1,300,000,000 fine ounces. The Treasury started in "enthusiastically," and during the first year and a half acquired about 850,000,000 fine ounces. In 1936 it slowed down, but bought approximately 350,000,000 fine ounces. Of this, 60,000,000 oz. represents American production, somewhere between 100,000,000 and 150,000,000 oz. was purchased from China and the remainder presumably is largely new silver from Canada and Mexico, with which the Treasury also made agreements, plus open-market purchases to support the price. Total acquisitions to the end of 1936 thus are about 1,200,000,000 oz., or nearly the original quota. Meanwhile, however, the Treasury has been steadily acquiring gold, so that it is still necessary to buy about 900,000,000 oz. more silver to carry out the terms of the law.

Summarizing, one may say that prior to the depression, the two great factors in the demand for silver were the Indian ornament trade and the Chinese monetary system. Between them they took about 80 per cent of the new production during the 1920's, while the remainder, with the not inconsiderable supplies of demonetized silver which came on the market in that period, supplied the arts and industries and the small production of subsidiary coinage in western countries. The Indian ornament trade has revived this year and shows promise of being a factor in the future as in the past. The Chinese monetary demand, however, has been destroyed as a result of the American legislation which raised the price of silver to a high level. That spelled deflation to the country which was the last stronghold of the silver standard, and forced it to abandon silver, in all probability permanently. Considerable supplies of silver may be expected to come on the market from China for several years. It is unlikely that any other countries will make extensive use of silver for monetary purposes, let alone adopt the silver standard; the great fluctuations in the price during the last two decades, partly due to economic forces and partly to American politics, have shown the inconvenience of using silver except as subsidiary coins of low fine content.

The silver market, therefore, must depend largely on the demand for the arts and industries in Europe and America, approximately 50,000,000 oz. per year, and on the Indian demand, which may be between 50,000,000 and 100,000,000 oz. With annual production approaching its old levels of 250,000,000 oz., this leaves 100,000,000 to 150,000,000 oz. of excess new production, plus whatever quantities may be dumped from China and elsewhere.

The only purchaser for this surplus is the United States Treasury, which is required by law to continue buying until the goal of the 1934 act is reached. It is hardly to be thought that the Administration is very enthusiastic about silver; practically no reference was made to the subject during the campaign, even in the mining states. On the other hand, there is no opposition strong enough to force repeal. The course of least resistance will be for the Treasury to continue purchases on the scale of 1936 and keep the price pegged at the current level.

WORLD'S SILVER PRODUCTION

In Fine Ounces

Country	1933	1934	1935	1936
United States	20,955,000	26,441,000	38,322,000	62,150,000
Canada	15,187,950	16,415,282	16,624,426	18,150,000
Mexico	68,101,062	74,143,301	75,587,447	78,000,000
Peru	7,316,828	10,381,397	16,000,000	18,700,000
Other America	12,041,677	11,203,776	11,580,385	16,000,000
Europe	15,311,822	14,249,365	15,692,275	16,250,000
Australasia	11,552,397	11,284,396	11,923,066	13,000,000
Japan	5,967,362	6,882,011	8,124,000	9,500,000
India	7,300,000	6,850,000	6,860,000	7,000,000
Other Asia	1,793,408	1,888,998	1,970,000	2,100,000
Africa	4,117,261	4,705,312	5,274,455	5,500,000
World totals	169,644,767	184,444,838	207,958,054	246,350,000

Production statistics refer to new silver. Figures for 1933, 1934, and 1935 are by the American Bureau of Metal Statistics; 1936 estimated by *E&MJ*.

▼ ▼ ▼

GOLD

(*Continued from page 55*)

possibilities, but also because there is no industry in the world which is subjected to such heavy reduction from profits through excessive taxation. Increasing production costs seem inevitable for some time to come and must largely be deducted from profits, which is another adverse factor with which the gold-mining industry is confronted in the open capital market. However, the development of the gold-mining industry is not altogether dependent on outside capital. The large profits which have been earned in the past few years and which will probably continue, if on a reducing scale for some years to come, constitute in the future, as they have in the past, an independent reservoir from which to draw new investment capital.

COPPER

Consumption and production up sharply. Advance of foreign price above domestic unwelcome

W. R. Ingalls
Director
American Bureau of Metal Statistics

THE broad economic trend in 1936, especially in the United States, was strongly upward, and the course of copper fell naturally into the same slot. The conditions of a sharp upgrade, like those of a sharp downgrade, produce statistical unbalances that may be misunderstood.

Our true domestic consumption of copper, new and old, will probably prove to have been somewhere between 725,000 and 750,000 tons in 1936, with an average monthly rate of about 50,000 in the first quarter, 67,000 in the second, 60,000 in the third (when there is naturally a seasonal recession), and perhaps 67,000 in the fourth. The total is to be compared with 567,000 in 1935. The increase in 1936 occurred mainly under the heads of electric manufactures, building construction, and the making of motor vehicles. There was some increase in the use for light and power lines, and also an increase, but less, for communication (telephone and telegraph). Consequently, the copper and brass mills did much better in 1936 than the wire and cable mills.

Shipments of refined shapes ex refineries will aggregate substantially more than consumption, for the reason that as consumption has increased the manufacture of the primary fabrications has also had to increase, and likewise manufacturing inventories, previously scaled down, replenishment of which absorbed more or less of the shipments ex refineries. Another expression of this would be transfer of stocks from visible position into the invisible.

The production by domestic mines naturally experienced a substantial increase, which contributed very much to their prosperity. Economically, however, the magnitude of domestic production continues to be immaterial, inasmuch as our producing capacity, rated at about 900,000 tons per annum, is still in excess of domestic requirements plus foreign outlet.

Outside of the United States consumption was steady at the rate of about 100,000 tons per month, or about the same as in 1935, in terms of new copper. Production during the first three quarters averaged about 95,000 tons per month, so there was a steady reduction of stock.

A breakdown of foreign consumption shows that Great Britain has been using a little more copper than in 1935, while Germany has been using less. The reason for the latter is that Germany, being short of domestic supply and being crippled with means to buy from elsewhere, has been restricting the use of copper to the essentials, governmental decree compelling the use of substitutes in every possible way.

The most powerful impulse to copper outside of the United States in 1936 was the prospective institution of a rearmament program, especially in Great Britain. About midsummer

(*Continued on page 67*)

WORLD'S COPPER PRODUCTION

In Short Tons

Country	1933	1934	1935	1936
United States	233,649	240,099	380,100	605,000
Canada	148,290	183,415	208,224	205,000
Mexico	43,742	52,116	45,880	38,000
Chile	180,110	282,965	294,684	265,000
Peru	27,419	30,572	32,600	35,500
Germany	34,171	26,455	27,558	30,000
Russia	36,034	48,587	69,445	89,000
Other Europe	119,313	124,804	129,301	135,000
Japan	67,000	66,100	72,752	75,500
Africa	200,430	290,682	295,987	270,000
Elsewhere	47,230	41,965	46,601	48,500
World totals	1,137,388	1,387,760	1,603,132	1,796,500

So far as possible, these statistics are based on blister copper, referred to countries wherein ore originated. In other words, new copper. Figures for 1933, 1934, and 1935 by American Bureau of Metal Statistics; 1936, *E&MJ* estimate.

LEAD

Revival in consumption marks close of year. Price advances, following an upturn in London

F. E. Wormser
Secretary
Lead Industries Association

THE most interesting chapter in the lead market was the closing one for the year 1936. Then occurred a series of rapid advances in the price of lead in London, so frequent and sharp that they set the pace for the entire world, and made it difficult for New York to keep abreast of London. In fact, for several days in December the spread between the London and New York markets was wide enough to make shipments from the United States to Europe tempting—an unprecedented but temporary situation.

At the time of writing it is difficult to say just what is in store for lead in the near future, owing to this unusual relationship between the two great markets. In the long run, the ordinary relationship, whereby New York rules higher than London, will prevail, either through a decline in the demand for lead abroad, or an increase in the amount of pig lead for sale from Australia, Mexico, and Canada. The possibility of shipment abroad is slight.

On the whole, the year 1936 was the most cheerful for lead since 1930. It was one of substantial improvement in the statistical position, as explained below, and was noted for an advance in price from 4.50c. to 6.00c. per pound, New York, at the end of the year, with most of the advance occurring since October.

Sales of pig lead for the first six months of 1936 (35,000 tons per month) showed but a moderate improvement over the corresponding period of 1935 (30,000 tons per month), but in July a spurt in the demand reached such proportions that almost 70,000 tons were sold in four weeks. For the remainder of the year sales averaged close to 60,000 tons per month. All sellers had to dip into stocks to supply the unusual demand; some sellers exhausted their accumulations completely.

At the same time, the foreign lead market showed remarkable strength and gradually reached a point where the prices of New York and London lead were the same. Finally, in December, the London market passed New York, placing the American lead industry, for the first time that I can recall, definitely upon an export basis for a short period. The strength of the market in London was ascribed in large measure to a demand for lead by various European countries for munitions, to speculation, and to a growing demand for lead for building and other peace-time uses.

To cap the climax, a strike in Utah among the lead miners occurred in October, which was not settled until December, and created a shortage of supplies from one of the three most important lead-producing states. It was not surprising, therefore, that, as a result of all these national and international developments, the pig-lead stocks in the United States melted away month after month at the rate of some 10,000 to 15,000 tons each month. Pig-lead stocks have always been held by producers in the lead industry strong enough financially to carry the burden indefinitely. They were, nevertheless, large enough to place lead in an unfavorable statistical position. Refined pig-lead stocks, including antimonial lead, were 224,000 tons at the beginning and 172,400 tons at the end of the year.

The problem producers face is, will the lead market stay on a higher scale, or will it subside? It is not easy to increase production of pig lead quickly. American demand of lead lately has been on a scale close to that of 1929. If it continues the spotlight will have to be turned on the prospect of adequate domestic supplies.

Indications point to a maintenance of the higher rate of demand for lead. It is well to remember that for several years—namely, from 1925 to 1930 inclusive—lead derived from mining operations was produced and consumed in the United States at the rate of 63,000 tons per month, but from the years 1931 to 1935 the production averaged only 27,000 tons per month and even this low rate resulted in an increase in stocks.

The average price of pig lead in New York for 1936 was 4.710c. per pound, which continues the improvement noted in 1935, as the following table shows:

Average Annual Lead Price

(Cents per pound, New York)

1925	9.020	1931	4.243
1926	8.417	1932	3.180
1927	6.755	1933	3.869
1928	6.305	1934	3.860
1929	6.833	1935	4.065
1930	5.517	1936	4.710

During 1936 there was a notable increase in the demand for lead by cable manufacturers. Some 45,000 tons of lead were shipped for cable sheath purposes, compared with about 25,000 tons in 1935. There is still room for improvement in this outlet and the demand is still far below the pre-depression rate of 200,000 tons annually.

The use of lead in foil almost doubled itself during 1936 and will consume about 27,500 tons. Similarly, there was a modest increase in the lead pigment field. We estimate that the improvement here will amount to some 10 per cent. Use of lead in the plumbing industry also shows an increase of about 15 per cent. New lead for storage battery requirements showed an improvement of about 10 per cent. This outlet is not as important as it seems, inasmuch as most battery lead is reclaimed.

As demand for lead increases, the importance of the secondary-lead market, which at the depth of the de-

(Continued on page 67)

WORLD'S LEAD PRODUCTION

In Short Tons

Country	1933	1934	1935	1936
United States	292,543	330,911	371,212	431,000
Canada	129,932	159,833	165,357	180,000
Mexico	139,738	193,547	204,172	231,000
Germany	128,528	132,276	134,811	158,500
Italy	27,289	46,241	39,870	46,800
Spain	102,473	82,516	78,068	60,000
Russia	15,070	29,985	40,565	55,000
Other Europe	130,839	155,503	158,208	168,000
Australia	233,532	226,336	243,046	220,000
Burma	80,694	80,437	80,707	81,500
Elsewhere	36,534	52,525	49,663	57,000
World totals	1,317,172	1,490,110	1,565,679	1,688,800

In general, the statistics cover production in terms of bullion, allocated according to origin of ore. Figures for 1933, 1934, and 1935 by American Bureau of Metal Statistics; 1936, *E&MJ* estimate.

ZINC

Failure to revive cartel leaves European producers uncertain, compared with domestic trade

O. W. Roskill
London, England

CONTINUATION of the unsatisfactory statistical position of zinc abroad marked 1936, and so far it seems unlikely that 1937 will see much improvement. In most countries production has increased and in many cases productive capacity has been added to during 1936, world production outside the United States increasing by nearly 4 per cent. Consumption has improved, but not enough to prevent an increase in stocks.

The beginning of the year 1936 saw efforts to reconstitute the international cartel which had been terminated with 1934. Negotiations were carried on until mid-year, when to the difficulties previously had were added the outbreak of war in Spain and the impossibility of estimating future productive capacity. The original difficulties had been due in part to the artificial encouragement of the zinc industries of certain countries striving for self-sufficiency. The zinc-smelting industry is considered of national importance from the point of view of defence. It is impossible to anticipate any decrease in the movement towards national sufficiency, which in Germany has taken the form of subsidies according to production and grants in aid of extensions of plant, accompanied by a rigid control of imports; in France and French North Africa the form of subsidies for ore production and a tariff on lead imports; and in Great Britain and other countries the form of a tariff.

The most obvious example of government-sponsored production is in Germany, for which the 1935 figure of production was 70 per cent over that of 1934, reaching 124,200 metric tons. In 1936 German production is likely to be about 135,000 metric tons. The Magdeburg electrolytic plant and the new Oker smelter treat Upper Silesian ores, previously sent to the Polish custom smelters, and Harz ores, respectively, and it is now necessary to secure

zinc ore from abroad, 90,000 tons being imported in 1935. In addition, the German Base Metals Control Board rigidly restricts imports of metal.

Formerly much zinc was exported to Germany by Poland and Belgium, whose smelting industries have been severely hit by the growth of German domestic production. Poland has been encouraging the mining of her own zinc ore in an endeavor to maintain production at her smelters, and a considerable mine capacity appears available. Belgium is almost entirely a custom smelting country, and, after the United States, is the largest producer of refined zinc. Devaluation of the belga in 1935 put the industry again on a profit-making basis and eager for the reconstitution of the cartel. In the absence of a cartel and with the possibility of increased tariffs in Great Britain, the future of Belgian smelters is somewhat insecure, and a certain measure of restriction is said to have been agreed to among the smelters.

In Italy, the self-sufficiency movement was intensified by the sanctions imposed by Geneva. Government assistance took the form of a subsidy scheme which permitted profitable production of lead and zinc, in ore or as metal, without regard to international prices. Production for January-June was about 14,000 metric tons, compared with 26,263 for 1935.

Among the countries with a less rigid government control of industry, Canada has been increasing in importance steadily, and its ore reserves, as yet not fully prospected, are probably now the largest in the world. The 1935 production was 10.5 per cent above that of 1934 and was the best for ten years. This figure will probably be exceeded by the 1936 output, owing to developments by the Consolidated Mining & Smelting Company and the Hudson Bay Mining & Smelting Company. Buchan's Mining Company, in Newfoundland, has been producing to capacity.

In Australia, Broken Hill Proprietary began producing zinc concentrates in 1936, production so far being only about 4,200 tons per month. Output of the Broken Hill area increased rapidly, and mainly on this account the total Australian output, which in 1935 increased by 25 per cent over 1934, in 1936 showed a further considerable increase. During 1936 production costs at Broken Hill were increased by the new agreement made with the unions and by increased freight charges. In July, the New Broken Hill Consolidated Company was formed, but production of concentrates will not begin before 1940.

In Tasmania, the west coast mines of the Electrolytic Zinc Company restarted production in February, 1936, and mill production totaled 16,800 tons of zinc concentrates up to June 30, 1936. Total zinc output of the Electrolytic Zinc Company for 1935-36 was about 71,250 tons.

Rhodesia-Broken Hill, which in 1935 produced nearly 6 per cent more zinc than in 1934, is to increase its output of zinc concentrates to 25,000 tons per annum.

In Great Britain a certain amount of protection has been given to the home producer, but the Imperial Smelting Corporation has had to stop the production of zinc at Seaton Carew and has under consideration the closing of the zinc section at Bloxwich. A higher duty is thought necessary. Practically all zinc smelting in Great Britain is done from imported ores.

In France and French North Africa the effect of the government subsidies on ore production after July 1, 1935, and the tariff on zinc imports, was not up to expectations, and through 1936, up to the devaluation of the franc, French zinc production showed no appreciable increase. The devaluation

(*Continued on page 67*)

WORLD'S ZINC PRODUCTION

In Short Tons

Country	1933	1934	1935	1936
United States	324,705	366,933	431,499	524,270
Canada	91,963	134,926	149,103	156,000
Mexico	30,712	40,354	44,084	48,500
Belgium	151,346	192,792	201,346	202,000
France	61,217	56,410	56,729	59,000
Germany	56,071	80,358	136,906	148,000
Great Britain	45,987	57,344	67,717	69,000
Poland	93,397	102,522	93,688	93,000
Australia	60,425	59,880	74,856	78,000
Rhodesia	20,767	21,884	23,122	25,000
Elsewhere	170,274	191,649	208,333	228,230
World totals	1,106,864	1,305,052	1,487,383	1,631,000

Production of zinc by primary metallurgical works. Figures for 1933, 1934, and 1935 are by American Bureau of Metal Statistics; 1936, *E&MJ* estimate.

Prices lower, consumption higher. International agreement renewed at year's end, to run to 1942

E. Baliol Scott
Editor, "The Mining Journal"
London, England

IN THE tin industry 1936 was a notable year, partly because a new International Tin Agreement was finally effected in the last days of December, covering some 90 per cent of the world's production, and that for a period of five years as against three, and partly because of the apparently remarkable increase in consumption indicated towards the end of the year.

In the review a year ago it was anticipated that a new Tin Agreement would eventually be secured during the course of the year, but 1936 had practically run its course before news came that the Siamese Assembly had decided to ratify the terms of the New Agreement giving Siam a standard tonnage of just over 18,000 tons of tin and a minimum flat rate of just under 11,500 tons. The new agreement was officially announced on Jan. 5, 1937. We have still to learn what modifications have been introduced in its terms. One difficulty experienced particularly during the course of 1936, owing to the failure of Bolivia, and to a very minor extent Indo-China and Nigeria, to export their full quotas, and thus having therefore large arrears of production which they could claim in subsequent years, has been obviated for the future by limiting the amount of carry-over from one year to another to 8⅓ per cent of the standard tonnage of any country under-exported. It was hoped at one time to do away altogether with the flat rate minima, but this was not acceptable to Siam, and possibly, though I am uncertain on this point, to the Congo. This, however, is a feature which should be of more importance in future years than in 1937. In May of the year under review the Bolivians canceled all their unfilled quota, and since then a further approximately 8,000 tons had accrued up till the end of the year. Altogether, the amount of unfilled quota to be carried forward into the New Agreement will probably be about 4,000 tons. Practically, how-

ever, it seems unlikely at present that Bolivia will be able to reach her full current quota for some time to come.

In consequence of Bolivia's shortage the international quotas for the year of three other "signatory" countries came out at the high figure of 92½ per cent. It is too early yet to present exact figures of production for each country, but the total world production would appear to have been between 170,000 and 175,000 tons, as compared with 140,522 tons, according to the I.T.C. estimate for 1935. What is perhaps more important is to estimate the outlook for probable production in the coming year on the basis of the quotas now existing. In official circles this is estimated somewhat as follows:

	Tons
Malaya	71,940
N. E. I.	36,330
Bolivia	25,000
Siam	15,000
Nigeria	10,890
Congo	8,000
Indo-China	1,500
Total	168,660
Rest of the world	17,000
Total	185,660

In this table it is assumed that the Bolivian shortage will continue well into, if not throughout, the current year. The Congo production may be somewhat underestimated, while the total for the non-restricting countries appears to be on the usual I.T.C. basis of net exports rather than actual output, and may prove to be, given the continuance of high prices, a little low. Thus the production from Burma last year appears to have been in the neighborhood of 4,750 tons and Chinese exports about 10,500 tons. The reasonable estimate, therefore, for production in the current year should lie between 185,000 and 190,000 tons on the basis of 100 per cent quotas.

The question naturally presents itself whether it will be possible to maintain those quotas coincidently with anything like current prices. If not, quotas will have to be cut or lower prices accepted. Hitherto the I.T C. has refused to give any indication of price policy. Whether anything of the kind will be adumbrated in the new agreement remains to be seen, but informally the idea has been allowed to emerge that the Committee may be disposed to consider £200 as a regulative price.

Total visible supplies, including carry-over, at the end of the year were 22,695 tons. It is thought that the I.T.C. would prefer a larger amount of stock than this, say 25,000 tons or possibly more; consequently, an effective quota of 90 per cent (international) should be possible for the first half of 1937.

Broadly speaking, it looks as though production, now that the New Agreement has been effected, is fully capable of meeting any demand which trade requirements are likely to make.

To predict what is likely to be the average level of prices during the year before us may savor of the presumptuous, but I am inclined to think that the outlook is for lower prices over the coming twelve months than those current when the year ended, and that somewhere around £200 may turn out to be not far wide of the mark. There can be little doubt that the success of the International Rubber Restriction Agreement will not be lost upon the I.T.C. In rubber a very close cooperation with consumers appears to have been established, and a serious weakness of the Tin Restriction Agreement is that this cooperation has not been secured. Efforts will certainly be made in quarters having experience of both agreements to induce more cooperation between American consumers and the I.T.C., and for the smooth working of the new scheme it is certainly desirable that these efforts should be seconded.

WORLD'S TIN PRODUCTION

In Long Tons

Country	1933	1934	1935	1936
Bolivia	14,746	20,634	27,168	24,027
Great Britain	1,337	1,999	2,053	2,100
China	8,200	8,500	9,500	10,500
Burma	3,153	4,061	4,500	4,750
Malaya	23,768	34,127	45,919	66,806
Siam	10,324	10,587	9,779	12,678
Netherlands E. Indies	14,181	18,418	24,632	31,416
Australia	2,810	2,986	3,050	3,150
Nigeria	3,651	4,996	6,977	9,529
Congo	1,956	4,356	6,400	6,700
Elsewhere	5,103	5,598	7,452	5,750
World totals	89,229	116,262	147,430	177,406

Tin production figures are on ore basis. Source: American Bureau of Metal Statistics for 1933, 1934, and 1935; 1936, *E&MJ* estimate.

NICKEL

Year sees new records in consumption and diverse application. More production facilities

Robert C. Stanley

President

International Nickel Company of Canada

THE YEAR 1936 established new records for the nickel industry in the volume and diversification of world consumption based on statistics for the first ten months of the period.

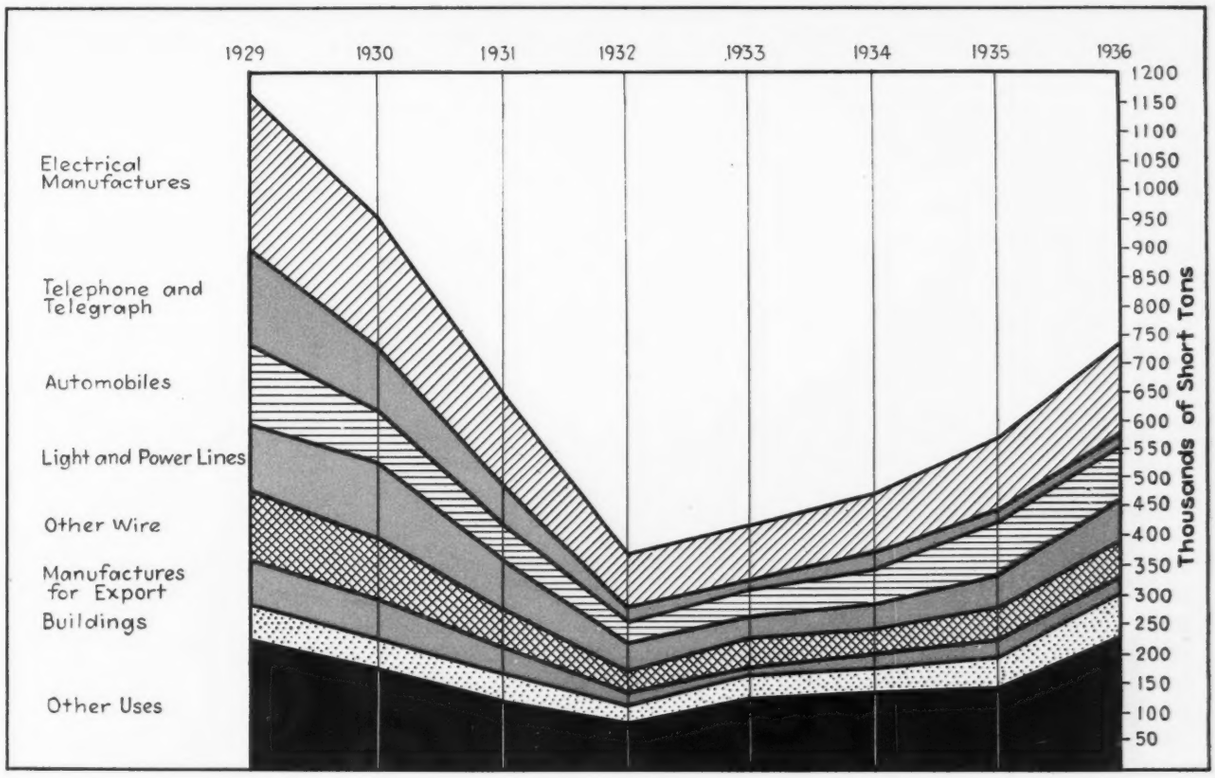
Because of the increase which has been steadily maintained in the demand for nickel since the low point in 1932, important additions to productive capacity were made during the year in Canada, the United Kingdom, the United States, and elsewhere. These additions, which both effected a better balance in production processes and added to potential output, provide the industry with the reserve capacity to maintain prompt deliveries under any conditions which can reasonably be anticipated. They affect the mines, smelters, refineries, and merchant mills.

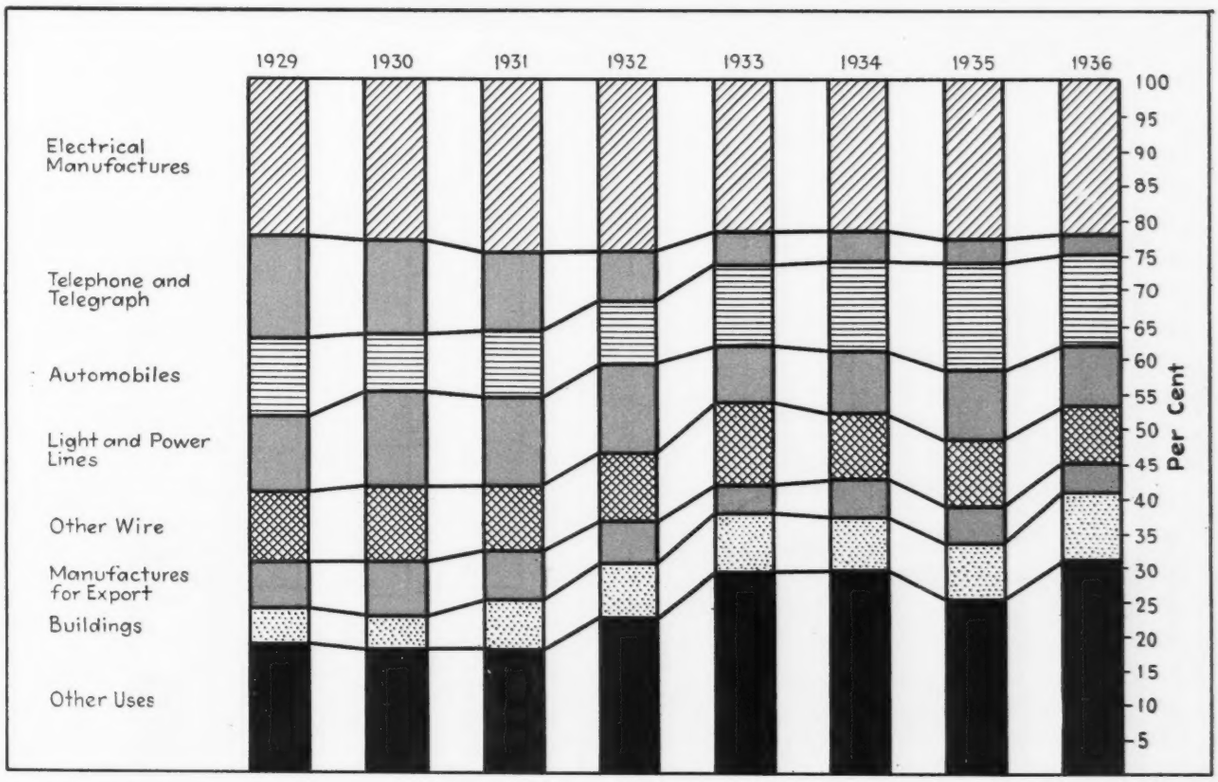
World consumption of nickel in all forms during the first ten months of 1936 attained a total of some 162,000,000 lb., an increase of more than 20 per cent over the corresponding figure in 1935 which had established a new record for the industry. This current consumption compares with 112,000,000 lb. in ten months of 1929.

Although political and economic developments in Europe affected the nickel industry, consumption of the metal continued to increase. The sanctions which obtained against Italy for the major part of the year and the German policy restricting importations of raw materials to minimum requirements naturally operated to reduce the volume. Yet these adverse conditions were more than offset by the trend, which has become pronounced especially in Great Britain, towards a wider use of nickel-bearing alloys in the broad fields of industry and engineering.

The steel industry, which is the dominant consumer of nickel, broadened its markets during the year and in consequence substantially increased the use of nickel alloy steels.

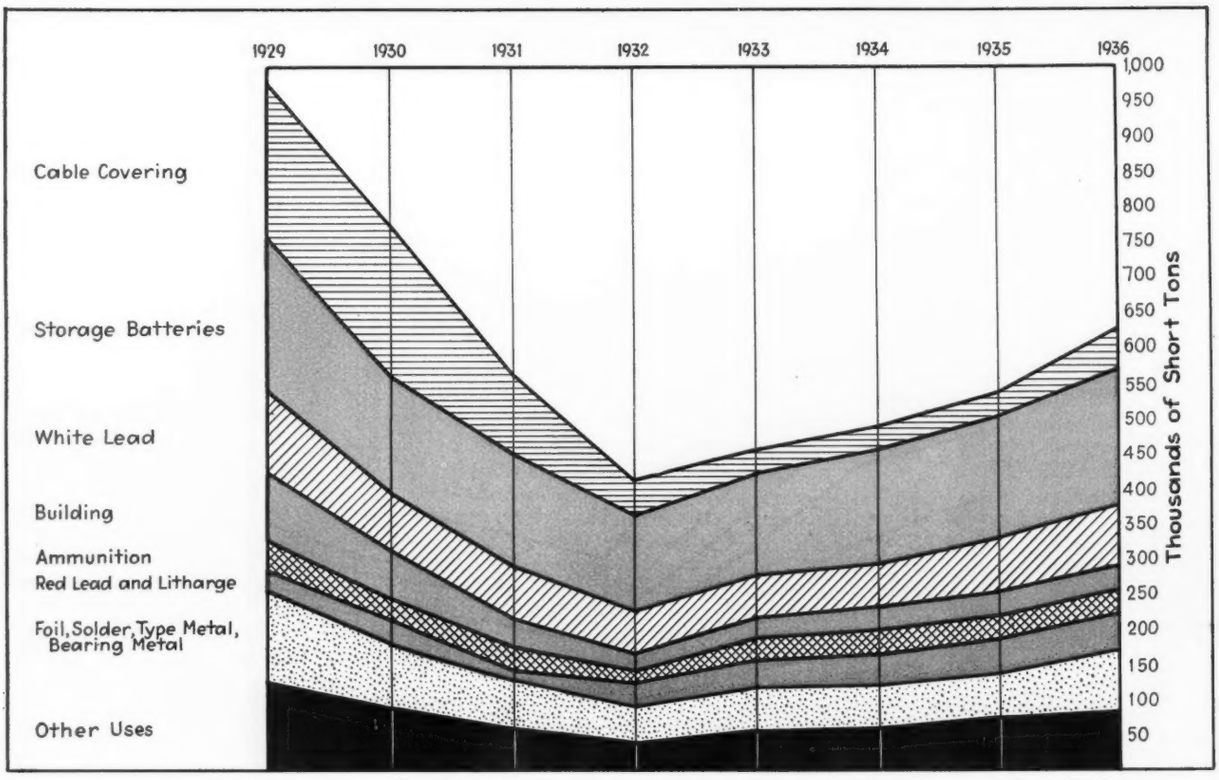
Trend in Use of COPPER *in the United States*

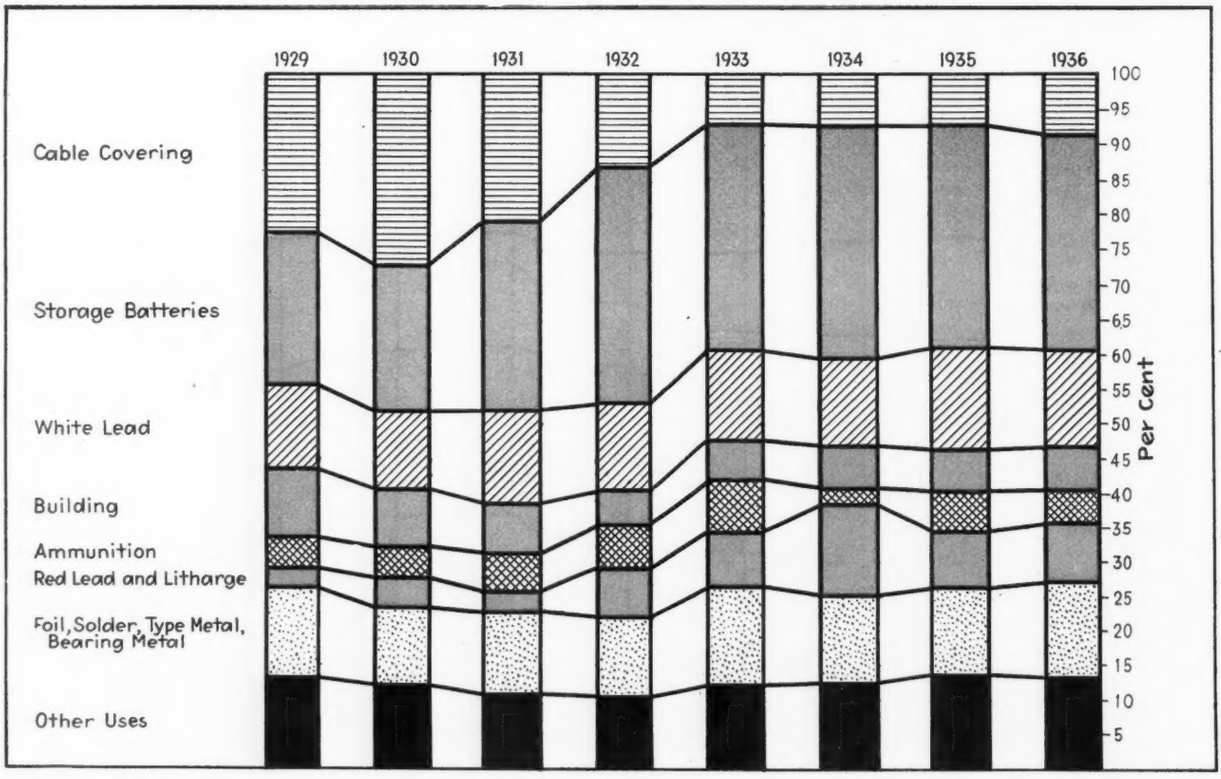




SOURCE: ***1925–1935, American Bureau of Metal Statistics; 1936, E&MJ estimate***

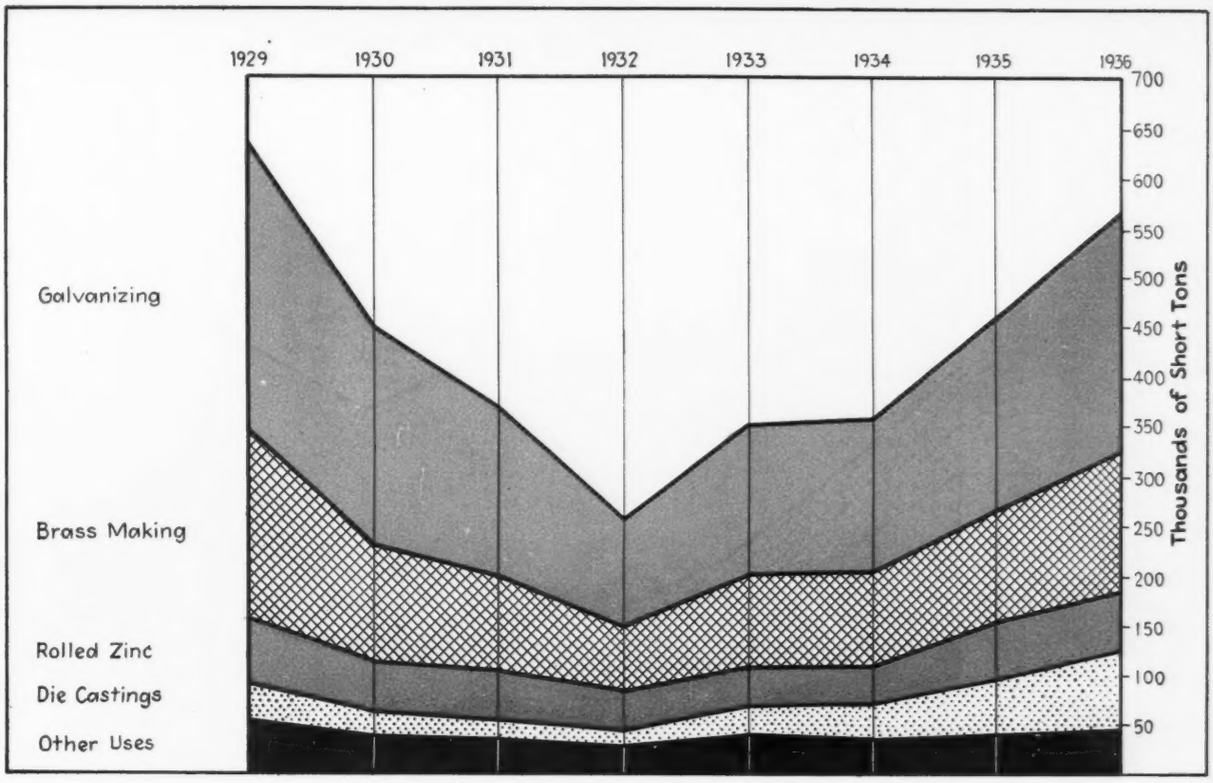
Trend in Use of **LEAD** *in the United States*

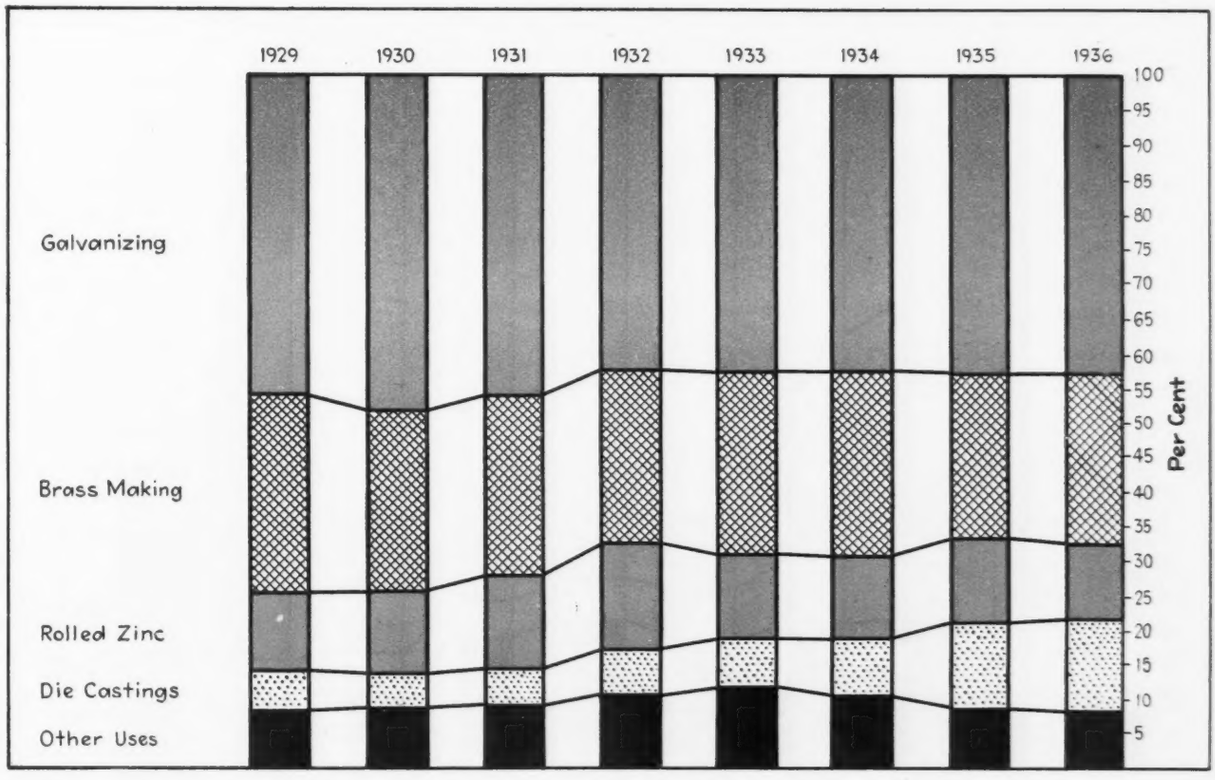




SOURCE: ***1925–1935, American Bureau of Metal Statistics; 1936, E&MJ estimate***

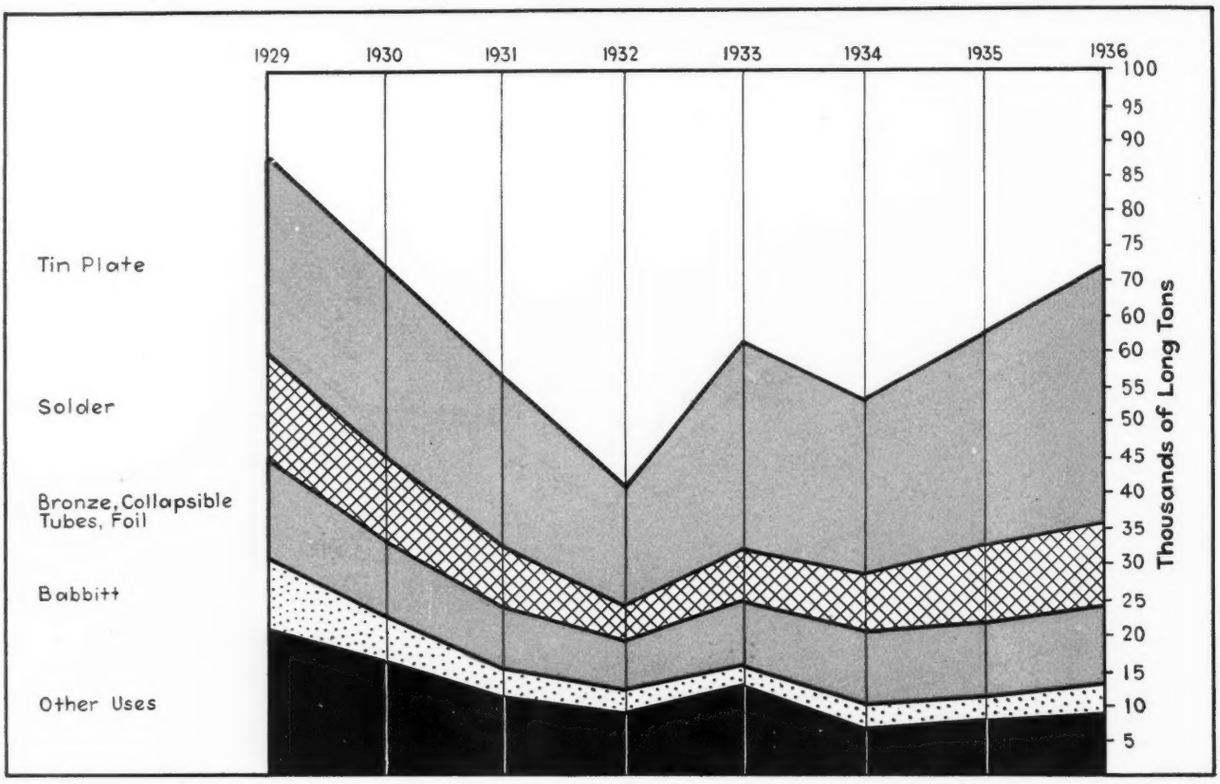
Trend in Use of **ZINC** *in the United States*

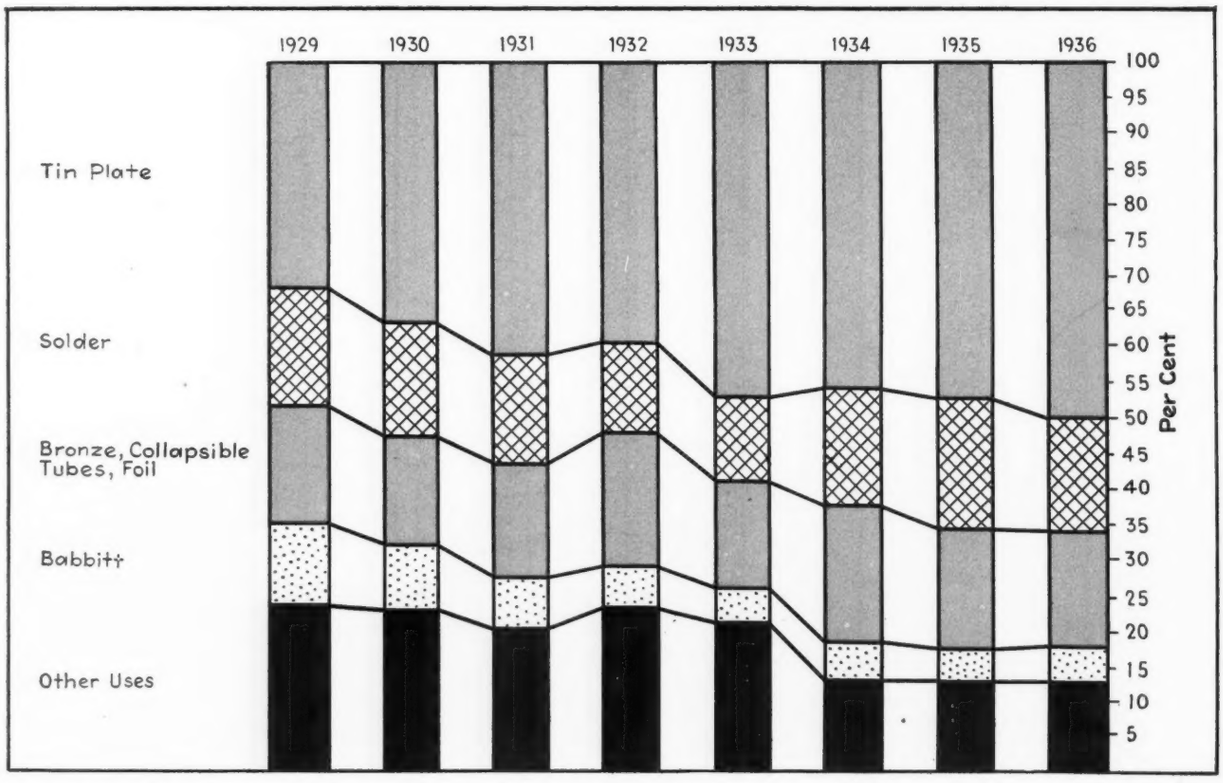




SOURCE: ***1925–1935, American Bureau of Metal Statistics; 1936, E&MJ estimate***

Trend in Use of **T I N** *in the United States*





SOURCE: *1925–1935, American Bureau of Metal Statistics; 1936, E&MJ estimate*

E & M J Metal Prices for 1936, by Days

Including Monthly Highs and Lows and Monthly Averages

JANUARY

Jan.	Copper, Electrolytic Domestic	Copper, Electrolytic Export	Tin, Straits, New York	Lead, Common, New York	Silver, New York (a)	Zinc, Prime Western, E. St. Louis
2	9.025	8.375	48.250	4.50	49.750	4.85
3	9.025	8.325	47.675	4.50	49.750	4.85
4	9.025	8.300	47.500	4.50	(b)	4.85
6	9.025	8.325	47.000	4.50	49.750	4.85
7	9.025	8.275	47.000	4.50	49.750	4.85
8	9.025	8.250	47.125	4.50	49.750	4.85
9	9.025	8.300	47.125	4.50	49.750	4.85
10	9.025	8.300	47.125	4.50	49.750	4.85
11	9.025	8.300	48.000	4.50	(b)	4.85
13	9.025	8.350	47.875	4.50	49.750	4.85
14	9.025	8.350	47.750	4.50	49.750	4.85
15	9.025	8.350	47.625	4.50	49.750	4.85
16	9.025	8.300	47.600	4.50	48.750	4.85
17	9.025	8.300	47.375	4.50	45.750	4.85
18	9.025	8.300	47.300	4.50	(b)	4.85
20	9.025	8.275	46.875	4.50	44.750	4.85
21	9.025	8.275	46.860	4.50	44.750	4.85
22	9.025	8.350	46.175	4.50	44.750	4.85
23	9.025	8.425	46.000	4.50	44.750	4.85
24	9.025	8.500	46.300	4.50	44.750	4.85
25	9.025	8.475	46.300	4.50	(b)	4.85
27	9.025	8.475	46.250	4.50	44.750	4.85
28	9.025	8.475	46.375	4.50	44.750	4.80@4.85
29	9.025	8.475	48.000	4.50	44.750	4.80@4.85
30	9.025	8.450	48.125	4.50	44.750	4.85
31	9.025	8.425	48.500	4.50	44.750	4.85
High	**9.025**	**8.500**	**48.500**	**4.500**	**49.750**	**4.850**
Low	**9.025**	**8.250**	**46.000**	**4.500**	**44.750**	**4.800**
Av'ge (c)	**9.025**	**8.358**	**47.234**	**4.500**	**47.250**	**4.848**

FEBRUARY

Feb.	Copper, Domestic	Copper, Export	Tin	Lead	(a) Silver	Zinc
1	9.025	8.425	48.375	4.50	(b)	4.85
3	9.025	8.400	48.125	4.50	44.750	4.85
4	9.025	8.375	48.000	4.50	44.750	4.85
5	9.025	8.425	47.875	4.50	44.750	4.85
6	9.025	8.450	47.625	4.50	44.750	4.85
7	9.025	8.450	47.750	4.50	44.750	4.85
8	9.025	8.450	47.750	4.50	(b)	4.85
10	9.025	8.475	47.875	4.50	44.750	4.85
11	9.025	8.525	48.125	4.50	44.750	4.85
12	Holiday	8.550	Holiday	Holiday	Holiday	Holiday
13	9.025	8.550	48.000	4.50	44.750	4.85
14	9.025	8.550	47.875	4.50	44.750	4.85
15	9.025	8.600	48.000	4.50	(b)	4.85
17	9.025	8.625	48.125	4.50	44.750	4.85
18	9.025	8.675	47.750	4.50	44.750	4.85
19	9.025	8.675	48.000	4.50	44.750	4.85
20	9.025	8.675	48.125	4.50	44.750	4.85
21	9.025	8.650	47.500	4.50	44.750	4.85
22	Holiday	8.650	Holiday	Holiday	Holiday	Holiday
24	9.025	8.650	47.500	4.50	44.750	4.85
25	9.025	8.675	47.500	4.50	44.750	4.85
26	9.025	8.675	47.875	4.55	44.750	4.90
27	9.025	8.675	48.750	4.60	44.750	4.90
28	9.025	8.650	48.375	4.60	44.750	4.90
29	9.025	8.650	48.250	4.60	(b)	4.90
High	**9.025**	**8.675**	**48.750**	**4.600**	**44.750**	**4.900**
Low	**9.025**	**8.375**	**47.500**	**4.500**	**44.750**	**4.850**
Av'ge (c)	**9.025**	**8.566**	**47.962**	**4.515**	**44.750**	**4.859**

MARCH

Mar.	Copper, Domestic	Copper, Export	Tin	Lead	(a) Silver	Zinc
2	9.025	8.650	48.000	4.60	44.750	4.90
3	9.025	8.650	48.000	4.60	44.750	4.90
4	9.025	8.650	48.250	4.60	44.750	4.90
5	9.025	8.675	48.875	4.60	44.750	4.90
6	9.025	8.700	48.625	4.60	44.750	4.90
7	9.025	8.775	48.500	4.60	(b)	4.90
9	9.025	8.775	48.375	4.60	44.750	4.90
10	9.025	8.775	48.250	4.60	44.750	4.90
11	9.025	8.775	48.125	4.60	44.750	4.90
12	9.025	8.725	48.375	4.60	44.750	4.90
13	9.025	8.725	48.250	4.60	44.750	4.90
14	9.025	8.750	48.250	4.60	(b)	4.90
16	9.025	8.750	48.375	4.60	44.750	4.90
17	9.025	8.700	48.250	4.60	44.750	4.90
18	9.025	8.700	48.250	4.60	44.750	4.90
19	9.025	8.725	48.125	4.60	44.750	4.90
20	9.025	8.725	48.000	4.60	44.750	4.90
21	9.025	8.725	48.000	4.60	(b)	4.90
23	9.025	8.700	47.875	4.60	44.750	4.90
24	9.025	8.700	47.750	4.60	44.750	4.90
25	9.025	8.675	47.500	4.60	44.750	4.90
26	9.025	8.625	47.500	4.60	44.750	4.90
27	9.025	8.600	47.500	4.60	44.750	4.90
28	9.025	8.700	47.500	4.60	(b)	4.90
30	9.025	8.700	47.200	4.60	44.750	4.90
31	9.025	8.750	47.250	4.60	44.750	4.90
High	**9.025**	**8.775**	**48.875**	**4.600**	**44.750**	**4.900**
Low	**9.025**	**8.600**	**47.200**	**4.600**	**44.750**	**4.900**
Av'ge (c)	**9.025**	**8.708**	**48.037**	**4.600**	**44.750**	**4.900**

APRIL

Apr.	Copper, Electrolytic Domestic	Copper, Electrolytic Export	Tin, Straits, New York	Lead, Common, New York	Silver, New York (a)	Zinc, Prime Western E. St. Louis
1	9.025	8.750	47.600	4.60	44.750	4.90
2	9.025	8.775	47.650	4.60	44.750	4.90
3	9.025	8.775	47.625	4.60	44.750	4.90
4	9.025	8.775	47.550	4.60	(b)	4.90
6	9.025	8.775	47.500	4.60	44.750	4.90
7	9.025	8.775	47.125	4.60	44.750	4.90
8	9.025	8.800	46.950	4.60	44.750	4.90
9	9.025	8.825	46.900	4.60	44.750	4.90
10	9.025	8.850	46.875	4.60	44.750	4.90
11	9.025	8.850	46.875	4.60	(b)	4.90
13	9.025	8.850	47.125	4.60	44.750	4.90
14	9.275	8.900	47.125	4.60	44.750	4.90
15	9.275	8.900	47.000	4.60	44.750	4.90
16	9.275	8.850	46.500	4.60	44.750	4.90
17	9.275	8.850	46.600	4.60	45.000	4.90
18	9.275	8.875	46.875	4.60	(b)	4.90
20	9.275	8.875	46.875	4.60	45.750	4.90
21	9.275	8.900	46.875	4.60	45.500	4.90
22	9.275	8.875	46.875	4.60	45.250	4.90
23	9.275	8.900	46.625	4.60	45.125	4.90
24	9.275	8.900	46.600	4.60	45.000	4.90
25	9.275	8.925	46.625	4.60	(b)	4.90
27	9.275	8.925	46.700	4.60	44.750	4.90
28	9.275	8.900	46.725	4.60	44.750	4.90
29	9.275	8.875	46.625	4.60	44.750	4.90
30	9.275	8.825	46.625	4.60	44.750	4.90
High	**9.275**	**8.925**	**47.650**	**4.600**	**45.750**	**4.900**
Low	**9.025**	**8.750**	**46.500**	**4.600**	**44.750**	**4.900**
Av'ge (c)	**9.169**	**8.849**	**46.963**	**4.600**	**44.892**	**4.900**

MAY

May	Copper, Domestic	Copper, Export	Tin	Lead	(a) Silver	Zinc
1	9.275	8.850	47.000	4.60	44.750	4.90
2	9.275	8.850	47.000	4.60	(b)	4.90
4	9.275	8.875	46.875	4.60	44.750	4.90
5	9.275	8.875	46.875	4.60	44.750	4.90
6	9.275	8.900	46.700	4.60	44.750	4.90
7	9.275	8.875	46.625	4.60	44.750	4.90
8	9.275	8.850	46.650	4.60	44.750	4.90
9	9.275	8.850	46.650	4.60	(b)	4.90
11	9.275	8.850	46.700	4.60	44.750	4.90
12	0.275	8.850	46.900	4.60	44.750	4.90
13	9.275	8.825	46.900	4.60	44.750	4.90
14	9.275	8.800	46.875	4.60	45.250	4.90
15	9.275	8.825	46.875	4.60	45.750	4.90
16	9.275	8.825	46.875	4.60	(b)	4.90
18	9.275	8.800	46.375	4.60	45.375	4.90
19	9.275	8.800	45.900	4.60	45.125	4.90
20	9.275	8.800	45.750	4.60	44.750	4.90
21	9.275	8.800	45.875	4.60	44.750	4.90
22	9.275	8.775	45.825	4.60	44.750	4.90
23	9.275	8.750	45.825	4.60	(b)	4.90
25	9.275	8.725	45.750	4.60	44.750	4.90
26	9.275	8.750	45.875	4.60	44.750	4.90
27	9.275	8.825	46.000	4.60	44.750	4.90
28	9.275	8.775	45.250	4.60	44.750	4.90
29	9.275	8.800	44.875	4.60	44.750	4.90
30	Holiday	8.800	Holiday			
High	**9.275**	**8.900**	**47.000**	**4.600**	**45.750**	**4.900**
Low	**9.275**	**8.725**	**44.875**	**4.600**	**44.750**	**4.900**
Av'ge (c)	**9.275**	**8.819**	**46.352**	**4.600**	**44.869**	**4.900**

JUNE

June	Copper, Domestic	Copper, Export	Tin	Lead	(a) Silver	Zinc
1	9.275	8.750	44.500	4.60	44.750	4.90
2	9.275	8.750	44.000	4.60	44.750	4.90
3	9.275	8.750	43.000	4.60	44.750	4.90
4	9.275	8.750	42.750	4.60	44.750	4.90
5	9.275	8.750	43.875	4.60	44.750	4.90
6	9.275	8.750	43.675	4.60	(b)	4.90
8	9.275	8.725	43.125	4.60	44.750	4.90
9	9.275	8.750	42.125	4.60	44.750	4.90
10	9.275	8.750	42.125	4.60	44.750	4.90
11	9.275	8.750	42.625	4.60	44.750	4.90
12	9.275	8.775	42.500	4.60	44.750	4.90
13	9.275	8.775	42.375	4.60	(b)	4.90
15	9.275	8.775	41.500	4.60	44.750	4.90
16	9.275	8.775	41.600	4.60	44.750	4.90
17	9.275	8.800	41.375	4.60	44.750	4.90
18	9.275	8.775	41.125	4.60	44.750	4.875
19	9.275	8.800	41.500	4.60	44.750	4.85
20	9.275	8.800	41.875	4.60	(b)	4.85
22	9.275	8.800	42.000	4.60	44.750	4.85
23	9.275	8.850	42.600	4.60	44.750	4.85
24	9.275	8.875	42.750	4.60	44.750	4.85
25	9.275	8.875	41.700	4.60	44.750	4.85
26	9.275	8.850	40.500	4.60	44.750	4.85
27	9.275	8.875	40.500	4.60	(b)	4.85
29	9.275	8.850	40.600	4.60	44.750	4.85
30	9.275	8.825	41.000	4.60	44.750	4.85
High	**9.275**	**8.875**	**44.500**	**4.600**	**44.750**	**4.900**
Low	**9.275**	**8.725**	**40.500**	**4.600**	**44.750**	**4.850**
Av'ge (c)	**9.275**	**8.790**	**42.204**	**4.600**	**44.750**	**4.880**

(a) Silver other than newly mined domestic. (b) No market on Saturday. (c) Monthly averages.

E & M J Metal Prices for 1936, by Days

Including Monthly Highs and Lows and Monthly Averages

JULY

July	Copper, Electrolytic Domestic	Copper, Electrolytic Export	Tin, Straits, New York	Lead, Common, New York	Silver, New York (a)	Zinc, Prime Western E. St. Louis
1	9.275	8.825	40.550	4.60	44.750	4.85
2	9.275	8.850	40.500	4.60	44.750	4.85
3	9.275	8.850	40.625	4.60	44.750	4.85
4	Holiday	8.875	Holiday	Holiday	Holiday	Holiday
6	9.275	8.875	41.675	4.60	44.750	4.85
7	9.275	8.875	42.125	4.60	44.750	4.75
8	9.275	8.875	43.400	4.60	44.750	4.75
9	9.275	8.875	43.500	4.60	44.750	4.75
10	9.275	8.900	43.375	4.60	44.750	4.75
11	9.275	8.925	43.500	4.60	(b)	4.75
13	9.275	8.925	44.750	4.60	44.750	4.75
14	9.275	8.925	44.375	4.60	44.750	4.75
15	9.275	8.925	44.300	4.60	44.750	4.75
16	9.275	8.950	43.500	4.60	44.750	4.75
17	9.275	8.975	43.250	4.60	44.750	4.75
18	9.275	8.975	43.625	4.60	(b)	4.75
20	9.275	9.075	44.250	4.60	44.750	4.75
21	9.275	9.125	43.725	4.60	44.750	4.75
22	9.275	9.150	44.000	4.60	44.750	4.80
23	9.525	9.150	43.625	4.60	44.750	4.80
24	9.525	9.100	43.425	4.60	44.750	4.80
25	9.525	9.125	43.625	4.60	(b)	4.80
27	9.525	9.125	42.000	4.60	44.750	4.80
28	9.525	9.150	42.125	4.60	44.750	4.80
29	9.525	9.175	43.150	4.60	44.750	4.80
30	9.525	9.100	42.825	4.60	44.750	4.80
31	9.525	9.125	42.750	4.60	44.750	4.80
High	**9.525**	**9.175**	**44.750**	**4.600**	**44.750**	**4.850**
Low	**9.275**	**8.825**	**40.500**	**4.600**	**44.750**	**4.750**
Av'ge (c)	**9.352**	**8.993**	**43.021**	**4.600**	**44.750**	**4.783**

AUGUST

Aug.	Copper, Domestic	Copper, Export	Tin	Lead	(a) Silver	Zinc
1	9.525	9.150	42.750	4.60	(b)	4.80
3	9.525	9.150	43.000	4.60	44.750	4.80
4	9.525	9.175	42.875	4.60	44.750	4.80
5	9.525	9.200	42.800	4.60	44.750	4.80
6	9.525	9.200	42.750	4.60	44.750	4.80
7	9.525	9.225	42.375	4.60	44.750	4.80
8	9.525	9.275	42.375	4.60	(b)	4.80
10	9.525	9.300	42.625	4.60	44.750	4.80
11	9.525	9.350	43.300	4.60	44.750	4.80
12	9.525	9.350	42.750	4.60	44.750	4.80
13	9.525	9.350	42.625	4.60	44.750	4.80
14	9.525	9.400	42.375	4.60	44.750	4.80
15	9.525	9.425	42.375	4.60	(b)	4.80
17	9.525	9.375	42.125	4.60	44.750	4.80
18	9.525	9.325	42.000	4.60	44.750	4.80
19	9.525	9.275	42.600	4.60	44.750	4.80
20	9.525	9.275	42.400	4.60	44.750	4.80
21	9.525	9.275	42.250	4.60	44.750	4.80
22	9.525	9.300	42.250	4.60	(b)	4.80
24	9.525	9.300	42.250	4.60	44.750	4.80
25	9.525	9.300	42.125	4.60	44.750	4.80
26	9.525	9.300	42.375	4.60	44.750	4.80
27	9.525	9.325	42.700	4.60	44.750	4.80
28	9.525	9.350	42.875	4.60	44.750	4.80
29	9.525	9.375	42.875	4.60	(b)	4.80
31	9.525	9.400	43.250	4.60	44.750	4.80
High	**9.525**	**9.425**	**43.300**	**4.600**	**44.750**	**4.800**
Low	**9.525**	**9.150**	**42.000**	**4.600**	**44.750**	**4.800**
Av'ge (c)	**9.525**	**9.297**	**42.579**	**4.600**	**44.750**	**4.800**

SEPTEMBER

Sept.	Copper, Domestic	Copper, Export	Tin	Lead	(a) Silver	Zinc
1	9.525	9.400	43.125	4.60	44.750	4.85
2	9.525	9.400	42.875	4.60	44.750	4.85
3	9.525	9.400	42.875	4.60	44.750	4.85
4	9.525	9.425	43.600	4.60	44.750	4.85
5	9.525	9.450	43.750	4.60	(b)	4.85
7	Holiday	9.475	Holiday	Holiday	Holiday	Holiday
8	9.525	9.475	44.625	4.60	44.750	4.85
9	9.525	9.475	45.200	4.60	44.750	4.85
10	9.525	9.450	44.875	4.60	44.750	4.85
11	9.525	9.525	44.500	4.60	44.750	4.85
12	9.525	9.575	44.500	4.60	(b)	4.85
14	9.525	9.600	45.250	4.60	44.750	4.85
15	9.525	9.650	44.875	4.60	44.750	4.85
16	9.525	9.600	44.500	4.60	44.750	4.85
17	9.525	9.575	45.000	4.60	44.750	4.85
18	9.525	9.575	46.000	4.60	44.750	4.85
19	9.525	9.575	46.000	4.60	(b)	4.85
21	9.525	9.575	45.500	4.60	44.750	4.85
22	9.525	9.600	45.000	4.60	44.750	4.85
23	9.525	9.575	45.000	4.60	44.750	4.85
24	9.525	9.575	45.175	4.60	44.750	4.85
25	9.525	9.575	45.300	4.60	44.750	4.85
26	9.525	9.525	44.675	4.60	(b)	4.85
28	9.525	9.525	45.250	4.60	44.750	4.85
29	9.525	9.525	45.400	4.60	44.750	4.85
30	9.525	9.500	46.000	4.60	44.750	4.85
High	**9.525**	**9.650**	**46.000**	**4.600**	**44.750**	**4.850**
Low	**9.525**	**9.400**	**42.875**	**4.600**	**44.750**	**4.850**
Av'ge (c)	**9.525**	**9.523**	**44.754**	**4.600**	**44.750**	**4.850**

OCTOBER

Oct.	Copper, Electrolytic Domestic	Copper, Electrolytic Export	Tin, Straits, New York	Lead, Common, New York	Silver, New York (a)	Zinc, Prime Western E. St. Louis
1	9.525	9.450	45.626	4.60	44.750	4.85
2	9.525	9.450	45.475	4.60	44.750	4.85
3	9.525	9.450	45.400	4.60	(b)	4.85
5	9.525	9.450	45.675	4.60	44.750	4.85
6	9.525	9.450	45.250	4.60	44.750	4.85
7	9.525	9.425	45.000	4.60	44.750	4.85
8	9.525	9.450	45.150	4.60	44.750	4.85
9	9.525	9.475	45.300	4.60	44.750	4.85
10	9.525	9.500	45.250	4.60	(b)	4.85
12	Holiday	9.550	Holiday	Holiday	Holiday	Holiday
13	9.525	9.600	44.500	4.60	44.750	4.85
14	9.525	9.650	44.750	4.60	44.750	4.85
15	9.525	9.675	44.450	4.60	44.750	4.85
16	9.525	9.700	44.450	4.60	44.750	4.85
17	9.525	9.700	44.375	4.60	(b)	4.85
19	9.525	9.700	45.000	4.60	44.750	4.85
20	9.525	9.700	44.550	4.60	44.750	4.85
21	9.525	9.725	44.125	4.60	44.750	4.85
22	9.525	9.800	43.950	4.60	44.750	4.85
23	9.525	9.825	44.200	4.60	44.750	4.85
24	9.525	9.850	44.200	4.60	(b)	4.85
26	9.525	9.850	44.000	4.60	44.750	4.85
27	9.525	9.825	44.625	4.70	44.750	4.85
28	9.775	9.875	45.625	4.70	44.750	4.85
29	9.775	9.900	46.375	4.80	44.750	4.85
30	9.775	9.975	46.125	4.80	44.750	4.85
31	9.775	10.050	45.925	4.80	(b)	4.85
High	**9.775**	**10.050**	**46.375**	**4.800**	**44.750**	**4.850**
Low	**9.525**	**9.425**	**43.950**	**4.600**	**44.750**	**4.850**
Av'ge (c)	**9.563**	**9.669**	**44.975**	**4.631**	**44.750**	**4.850**

NOVEMBER

Nov.	Copper, Domestic	Copper, Export	Tin	Lead	(a) Silver	Zinc
2	9.775	10.100	45.850	4.80	44.750	4.85
3	Holiday	10.200	Holiday	Holiday	Holiday	Holiday
4	9.775	10.325	47.500	4.90	44.750	4.85
5	9.775	10.375	49.500	5.00	44.750	4.85
6	9.775	10.425	50.900	5.00	44.750	4.85
7	9.775	10.475	50.625	5.00	(b)	4.85
9	10.275	10.500	53.500	5.00	47.500	4.90
10	10.275	10.450	53.750	5.10	47.500	4.95
11	Holiday	10.325	Holiday	Holiday	Holiday	Holiday
12	10.275	10.150	52.500	5.10	45.500	4.95
13	10.275	10.150	53.000	5.10	45.500	4.95
14	10.275	10.200	52.625	5.10	(b)	4.95
16	10.275	10.225	51.650	5.20	45.500	4.95
17	10.275	10.275	51.650	5.20	45.500	5.025
18	10.275	10.300	51.500	5.20	45.500	5.05
19	10.275	10.375	51.425	5.20	45.250	5.05
20	10.275	10.425	51.175	5.20	45.125	5.05
21	10.275	10.425	51.000	5.20	(b)	5.05
23	10.275	10.425	51.000	5.20	45.375	5.05
24	10.275	10.425	51.875	5.20	45.125	5.05
25	10.275	10.400	52.500	5.20	45.125	5.05
26	Holiday	10.425	Holiday	Holiday	Holiday	Holiday
27	10.275	10.450	52.600	5.20	45.125	5.05
28	10.275	10.450	52.500	5.20	(b)	5.05
30	10.275	10.450	52.000	5.20	45.125	5.05
High	**10.275**	**10.500**	**53.750**	**5.200**	**47.500**	**5.050**
Low	**9.775**	**10.100**	**45.850**	**4.800**	**44.750**	**4.850**
Ave. (c)	**10.161**	**10.349**	**51.392**	**5.114**	**45.431**	**4.974**

DECEMBER

Dec.	Copper, Domestic	Copper, Export	Tin	Lead	(a) Silver	Zinc
1	10.275	10.400	51.375	5.20	46.000	5.05
2	10.275	10.325	51.250	5.20	46.500	5.05
3	10.275	10.325	50.850	5.20	46.000	5.05
4	10.275	10.325	50.625	5.20	45.750	5.05
5	10.275	10.325	50.625	5.20	(b)	5.05
7	10.275	10.325	50.750	5.20	45.750	5.05
8	10.275	10.375	51.750	5.20	45.250	5.05
9	10.275	10.425	52.125	5.20	45.000	5.05
10	10.275	10.450	52.375	5.20	45.250	5.15
11	10.275	10.500	52.250	5.30	45.250	5.15
12	10.275	10.525	51.875	5.30	(b)	5.15
14	10.525	10.550	51.750	5.45	45.500	5.20
15	10.775	10.700	52.750	5.50	45.250	5.30
16	10.775	10.825	52.875	5.50	45.000	5.35
17	10.775	10.875	52.625	5.50	45.250	5.45
18	10.775	10.900	52.250	5.50	45.250	5.45
19	10.775	10.925	52.200	5.55	(b)	5.45
21	10.775	11.000	52.000	6.00	45.250	5.45
22	11.400	11.175	52.000	6.00	45.000	5.45
23	11.400	11.400	51.900	6.00	44.875	5.45
24	11.400	11.425	51.800	6.00	45.000	5.45
25	Holiday	Holiday	Holiday	Holiday	Holiday	Holiday
26	11.400	11.425	51.800	6.00	Holiday	5.45
28	11.400	11.525	52.250	6.00	45.250	5.45
29	11.4625	11.550	52.200	6.00	45.125	5.45
30	11.400	11.525	51.500	6.00	45.250	5.45
31	11.775	11.600	51.650	6.00	45.000	5.45
High	**11.775**	**11.600**	**52.875**	**6.000**	**46.500**	**5.450**
Low	**10.275**	**10.325**	**50.625**	**5.200**	**44.875**	**5.050**
Ave. (c)	**10.763**	**10.835**	**51.823**	**5.554**	**45.352**	**5.273**

(a) Silver other than newly mined domestic. (b) No market on Saturday. (c) Monthly averages.

E & M J

Annual Average Metal Prices 1897-1936

Year	Copper, (a) Electrolytic, Refinery	Tin, (b) New York	Lead, Common, New York	Silver, New York	Zinc, Prime Western (d) E. St. Louis
1897	11.29	13.67	3.58	59.790	4.12
1898	12.03	15.70	3.78	58.260	4.57
1899	16.67	25.12	4.47	59.580	5.75
1900	16.19	29.90	4.37	61.330	4.39
1901	16.11	26.74	4.33	58.950	4.07
1902	11.626	26.79	4.069	52.160	4.84
1903	13.235	28.09	4.237	53.570	5.191
1904	12.823	27.99	4.309	57.221	4.931
1905	15.590	31.358	4.707	60.352	5.730
1906	19.278	39.819	5.657	66.791	6.048
1907	20.004	38.166	5.325	65.237	5.812
1908	13.208	29.465	4.200	52.864	4.578
1909	12.982	29.725	4.273	51.502	5.352
1910	12.738	34.123	4.446	53.486	5.370
1911	12.376	42.281	4.420	53.340	5.608
1912	16.341	46.096	4.471	60.835	6.799
1913	15.269	44.252	4.370	59.791	5.504
1914	13.602	34.301(c)	3.862	54.811	5.061
1915	17.275	38.590	4.673	49.684	13.054
1916	27.202	43.480	6.858	65.661	12.634
1917	27.180	61.802	8.787	81.417	8.813
1918	24.628	88.750	7.413	96.772	7.890
1919	18.691	63.328	5.759	111.122	6.988
1920	17.456	49.101	7.957	100.900	7.671
1921	12.502	29.916	4.545	62.654	4.655
1922	13.382	32.554	5.734	67.528	5.716
1923	14.421	42.664	7.267	64.873	6.607
1924	13.024	50.176	8.097	66.781	6.344
1925	14.042	57.893	9.020	69.065	7.622
1926	13.795	65.285	8.417	62.107	7.337
1927	12.920	64.353	6.755	56.370	6.242
1928	14.570	50.427	6.305	58.176	6.027
1929	18.107	45.155	6.833	52.993	6.512
1930	12.982	31.694	5.517	38.154	4.556
1931	8.116	24.467	4.243	28.700	3.640
1932	5.555	22.017	3.180	27.892	2.876
1933	7.025	39.110	3.869	34.727	4.029
1934	8.428	52.191	3.860	47.973 (e)	4.158
1935	8.649	50.420	4.065	64.273 (e)	4.328
1936	9.474	46.441	4.710	45.087 (e)	4.901

(a) Lake copper 1897 and 1898; domestic copper only since 1932.
(b) 99 per cent tin, 1897 to 1920, inclusive; Straits tin thereafter.
(c) Average for eleven months. (d) New York zinc 1897 to 1902, inclusive.
(e) Other than newly mined domestic.
Prices are in cents per pound, except those for silver, which are in cents per troy ounce.

ZINC

(*Continued from page 59*)

of the franc at the end of September had more effect. Consumption at present is below the 1935 level, and revival of the zinc-producing industry is dependent upon general industrial recovery and satisfactory solution of present labor troubles.

On the whole, in spite of these difficulties, opinion in Great Britain is inclined to take a favorable view of prospects in France. Already a considerable revival in French steel production has occurred.

In Yugoslavia, the output of Trepca declined in the year to Sept. 30, 1936, by reason of the strike in May, and 82,234 metric tons (against 94,146) of zinc concentrates and 64,131 metric tons of lead concentrates was produced from 588,594 tons of ore. A fourth unit is being added to the concentrator.

Zinc output promises to increase considerably in several other countries. In Rumania a new company has been formed to erect a zinc smelter; in Czechoslovakia the two largest zinc producers have applied for an increased zinc duty so that they can profitably undertake to produce electrolytic zinc. In Japan, smelter capacity is said to be about to be increased; and in Russia new works have been built in the Ridder district.

It seems probable, therefore, that production will continue to expand, in the absence of a cartel, and it is uncertain whether consumption will increase during 1937 sufficiently to avoid a further deterioration in the statistical position. The recent increase in consumption is due mainly to the use of zinc in brass for engineering purposes and armaments, and galvanizing, which remains the principal use for zinc, is not showing a parallel revival. Diecasting in zinc is increasing rapidly in England, as in the United States, but has not yet reached a position of major importance.

Inasmuch as the fortunes of the United States zinc industry were closely tied in with the foreign market, because of the depressed price situation in zinc abroad over the first ten months of 1936, our review of the zinc industry for last year naturally centers on developments outside of this country.

The upturn in London prices for zinc that occurred in the last quarter of 1936 enabled domestic producers to take some advantage of the excellent United States statistics. Prime Western zinc in St. Louis averaged 4.901c. per pound in 1936, against 4.328c. in 1935.

The American Zinc Institute's figures for 1936 reveal that domestic stocks of zinc at the end of the year, covering all grades, totaled 44,756 short tons, against 83,758 tons a year previous and 119,830 tons at the end of 1934. Production amounted to 524,271 tons in 1936, which compares with 431,490 tons in 1935. Shipments to consumers increased from 465,746 tons in 1935 to 563,273 tons in 1936.—THE EDITOR.

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COPPER

(*Continued from page 57*)

this produced an anticipatory demand, perhaps more or less speculative, which raised the foreign price for copper above domestic parity. The advance was not checked by the repeated announcements of increased production pro rata by the principal African and Chilean producers. Actual appearance of the increased production was naturally delayed by physical conditions, and it will not be until after the turn of the year that we shall see the full magnitude of it and its effects.

In the meanwhile the persistent prevalence of the European price at super-parity produced a dangerous if not impossible international condition and constrained successive advances in the domestic price, which at first at least were made with more or less reluctance out of fear of inviting unwelcome new production and favoring the competition of other metals and substitutes.

The absorption of copper into armament and into military reserves has not yet appeared physically in the statistics, but it is expected that it will. At present no one knows to what extent this may be or in what degree it may be offset otherwise. The year ended, therefore, with a great deal of obscurity.

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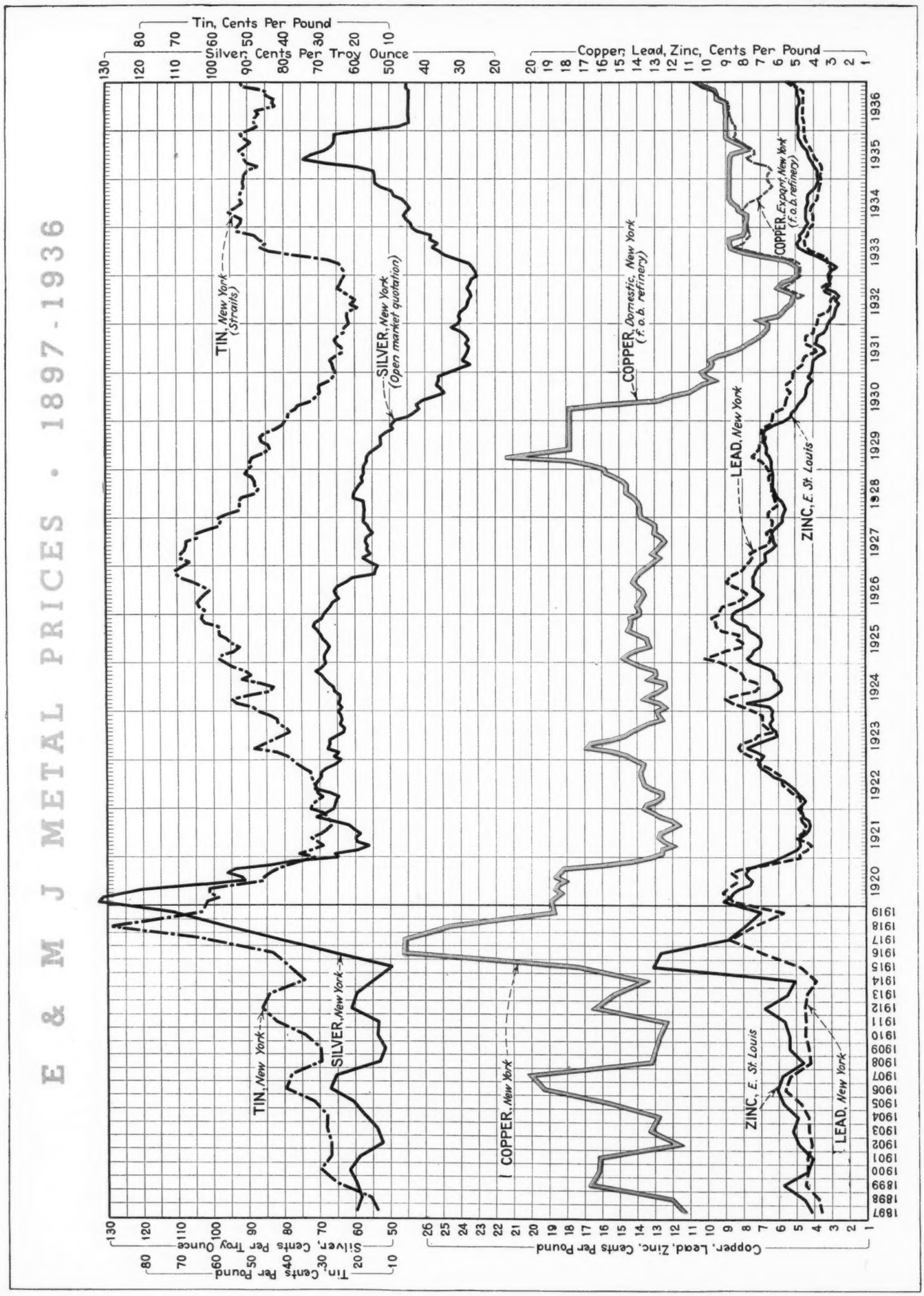
LEAD

(*Continued from page 58*)

pression was approximately equal in volume to the market for virgin lead, becomes less. As a matter of fact, receipts of old lead from battery plates and parts were about 10 per cent less in 1936 than in 1935. The secondary market also showed a decrease not only in the stocks of scrap material on hand but a decline in the stocks of soft lead manufactured from secondary material.

Changes in the domestic price of lead were made slowly. Sellers realize that frequent changes in the price of lead are upsetting to manufacturers and to the rate at which ore supplies are received at smelters. They also know that excessively high prices encourage substitution.

The future of the lead industry looks brighter than it has for many years. Practically the only cloud on the horizon is the growing labor trouble which affects numerous important lead markets.


E & M J METAL PRICES • 1897-1936
Tin, Cents Per Pound
Silver, Cents Per Troy Ounce
Copper, Lead, Zinc, Cents Per Pound
TIN, New York (Straits)
SILVER, New York (Open market quotation)
COPPER, Domestic, New York (f. o. b. refinery)
COPPER, Export, New York (f. o. b. refinery)
LEAD, New York
ZINC, E. St. Louis
COPPER, New York
TIN, New York
SILVER, New York
ZINC, E. St. Louis
LEAD, New York
1897 1898 1899 1900 1901 1902 1903 1904 1905 1906 1907 1908 1909 1910 1911 1912 1913 1914 1915 1916 1917 1918 1919 1920 1921 1922 1923 1924 1925 1926 1927 1928 1929 1930 1931 1932 1933 1934 1935 1936

CANADA

Dominion's Mineral Industry Booms

Output Reaches New High

John B. DeMille
Consulting Geologist
Montreal, Que.

WITH 55 new producers extending the total number of Canadian gold mines to 161 in 1936, gold production for the year amounted to approximately 3,720,505 oz., valued at $130,329,000. This figure is more than double the output of ten years ago and 13 per cent over that of 1935. In value the output of Canada's mineral industry as a whole exceeded that of 1935, the previous peak year, by upwards of 15 per cent, to reach $360,340,000 in 1936.

The importance of mining in the national life of the Dominion is emphasized by comparison with other industries. Following an upward trend that began early in the century, it has shown a greater improvement over the record for 1935 than has any other Canadian industry except forestry. For several years the value of the Dominion's mineral output has exceeded all other national wealth except manufactures and agriculture.

Canada has strongly maintained its position in world markets as a leader in the production of nickel, platinum, and asbestos; ranking second in output of radium and zinc, third in silver and copper, and fourth in gold and lead. The price of gold averaged $35.03 per ounce for the year, compared with $35.19 in 1935. Silver was marketed at an average price of 45.13c. per ounce against 64.79c. in 1935. Lead, sold through the London market, averaged 3.87c. per pound and the average price for zinc in Canadian funds was 3.29c. per pound. Copper averaged 9.44c. compared with 7.80c. per pound in 1935, as reported by the Dominion Bureau of Statistics.

Although more than half the value of metals produced in 1936 came from the rapidly developing gold-mining industry, greater attention to base-metal operations has resulted from rising market demands. Aldermac Copper and Normetal, in Quebec, have plans for entering the production stage with a combined milling capacity expected to reach 1,500 tons per day before the end of 1937. Big Missouri, in British Columbia, and Sheritt-Gordon, in Manitoba, are both prepared to join the sixteen base-metal producers which were active in 1936.

The drop of 5,000,000 lb. in copper production was more than accounted for by the closing down in August, 1935, of the Anyox mine of Granby Consolidated. This company, however, will resume production in 1937 at its Copper Mountain mine, in British Columbia. Increased smelter capacity at Sudbury will combine with large new production in Quebec and on the Pacific Coast in 1937.

In metal mining the greatest advance over previous records was in nickel, which was up 21 per cent in quantity at 167,713,000 lb. and 23 per cent higher in value at $43,471,000. Canadian nickel supplies about 90 per cent of world consumption. About one-tenth of this product comes from the Falconbridge mine and the remainder from International Nickel. During 1936, B. C. Nickel Mines shipped nickel-copper ore to Japan, and there are prospects of starting regular production in 1937 from this new source.

Table I—Canadian Gold Mining Companies That Expect to Begin Production in 1937

Mining Property	District	Proposed Mill Capacity
ONTARIO		
Addington Mines (Rich Rock) (a)	Hastings	25
Amca Mines	Garrison	75
Associated Gold Min. & Fin. (Concordia)	Porcupine	20
Bey Mines (Ore Chimney) (c)	Hastings	50
Canusa Gold Mines	Porcupine	50
Clark Gold Mines	Kenora	....
Cole Gold Mines	Red Lake	100
Cordova	Hastings	....
Craig Gold Mines	Hastings	100
Delnite Mines (e)	Porcupine	200
Edgelake Gold Mining	Tashota	15
Elizabeth Gold Syndicate	Rainy River	25
Excello Mines	Porcupine	35
Golden Summit	Kirkland Lake	25
Kirkland Gold Rand	Kirkland Lake	300
Lakeland Gold (c)	Kirkland Lake	30
Lebel Oro Mines (c)	Long Lake	200
Leitch Gold Mines	Thunder Bay	75
Lucky-Kirkland Gold Mines	Kirkland Lake	25
Madsen Red Lake Gold	Red Lake	....
Michipicoten Gold (S. B. Smith) (c)	Michipicoten	50
New Golden Rose	Temagami	100
Ronda (Neville Canadian)	West Shining Tree	30
Shreiber Pyramid Gold	Shreiber	50
Sturgeon River Gold Mines	Sturgeon River	50
Tombill Gold Mines (Newmont)	Little Long Lac	100
Young-Shannon Gold Mines	Three Duck Lake	15
QUEBEC		
Aldermac Copper Corporation	Rouyn	1,000
East Malartic Mines	Malartic	....
Sigma Mines (Dome)	Bourlamaque	500
Sladen-Malartic Mines	Malartic	200
Tiblemont Island Mining	Tiblemont	50
Normetal Mining Corp. (d)	Dufresnoy	500
NOVA SCOTIA		
Maguma Belt Mines	Lunenburg	....
Nugold (Blockhouse-Dome)	Lunenburg	20
Richland Gold	Queens	50
BRITISH COLUMBIA		
Abco Mines	Vancouver Island	50
Big Missouri Mines (f)	Portland Canal	600
Congress Gold	Bridge River	....
Durango Gold Mines (Howard)	Nelson	100
Esperanza Mines	Alice Arm	30
Federal Gold	Bridge River	100
Gold Mountain Mines	Similkameen	50
Granby Consolidated M. S. & P. (Copper Mt.) (c)	Similkameen	2,500
Hedley Amalgamated Gold Mines	Similkameen	150
Perrier Gold Mines	Nelson	50
Taylor-Bridge River	Bridge River	50

(a) Controlled by Consolidated Mining & Smelting. (c) Former producer. (d) Base-metal property controlled by Mining Corporation. (e) Controlled by Sylvanite. (f) Base metals.

CANADA

Metals of the platinum group are also derived from the nickel-copper ores of the Sudbury district. The value of this product in 1936 was $7,741,000, compared with $1,656,055 in 1929. Selenium and tellurium, byproducts in the refining of blister copper, have been produced in Canada since 1931 in steadily increasing quantities. Cadmium was recovered at the Flin Flon zinc refinery of Hudson Bay Mining & Smelting for the first time in 1936. Production had formerly been limited to the Consolidated smelter at Trail, B. C., which continues also as the foremost producer of bismuth and arsenic.

The Consolidated Mining & Smelting Company's Sullivan mine, in British Columbia, is Canada's foremost producer of base metals. Lead production in 1936 from mines in British Columbia, Quebec, and Nova Scotia amounted to 377,965,000 lb., marking a 9 per cent increase over the output of the previous record year of 1934. The Sterling mine, in Cape Breton, was put in operation in 1936 by British Metal Corporation, to place Nova Scotia among base-metal producers for the first time. Increases in base-metal mining are expected to give an output of more than $17,000,000 in 1937. The value of the zinc output was 8 per cent higher than that of the 1935 production, and is expected to show an even greater advance in 1937. Zinc output in 1936 amounted to 326,916,000 lb.

Silver production has been declining for several years and is expected to show only a slight change in 1937. The largest single source at present is the Sullivan mine, with British Columbia accounting for more than half of the Canadian total. Output from the once-booming Cobalt camp is now less than byproduct silver from the Sudbury district. Silver is associated with Pre-Cambrian gold deposits of Canada in a ratio of about three to one. The 9 per cent increase over 1935 for silver, for a 1936 total of 18,089,000 oz., reflects general expansion throughout the metal-mining industry.

Radium assumed industrial proportions in Canada for the first time in 1936, according to an official statement by Eldorado Gold Mines. Following progress in mining, transporting, refining, and marketing the products of the large pitchblende deposits located at Great Bear Lake, during October and November, 1936, radium output reached two grams monthly. Total radium production up to Nov. 16 amounted to one ounce. Increased capacity of the Port Hope refinery, which is located more than 3,000 miles from the mine, should boost production to upwards of two ounces per year. It is stated that orders for radium to be filled in 1937 amount to more than $800,000.

Chromite production continued from the large ore deposit at Obanga Lake, controlled by Chromite Mining & Smelting Corporation. A 27-mile road has been built to the railway and a complete mining plant installed. Smelter capacity at Sault Ste. Marie has been enlarged, and it is officially reported that 300,000 lb. of standard ferrochrome had been produced to the end of November, 1936. The mining of both chromite and molybdenite was stimulated during the war years and is now being revived. In 1936 Phoenix Molybdenite Corporation began operating a 50-ton concentrator, planning expansion. Other similar properties may be reopened in 1937.

The Aluminum Company of Canada, treating ore shipped from British Guiana, completed the most successful year in the company's history. Early in 1936 a large refinery was completed at Arvida, Quebec, and work is now in progress to double the capacity of this plant.

Among the non-metallic minerals produced in Canada, asbestos ranks second to coal in value. In 1936 there was a 46 per cent increase over the figures for 1935, the output of 307,596 tons, valued at $10,131,000, exceeding the previous record of 1929. All Canadian asbestos is produced in the Province of Quebec. The production of salt, mined in Nova Scotia, Ontario, and Manitoba, increased by 7 per cent to a new record of 349,149 tons. Gypsum went up 46 per cent to 788,287 tons, coming chiefly from Nova Scotia, where much of the product is shipped in the crude state to the United States. Magnesite for refractories showed a considerable increase over the record for 1935. Sulphur increased 56 per cent, production coming from pyrite concentrates and from smelter gases. Other important non-metallics produced in Canada in 1936 include sodium sulphate, talc, nephelinesyenite, magnesium sulphate, iron oxides, graphite, diatomite, mica, quartz, and feldspar. The value of all structural materials increased 15 per cent over the figures for 1935, and cement was better by 24 per cent. The combined value of cement, lime, clay products, stone, sand, and gravel was $26,670,000.

Close cooperation from Federal and Provincial governments during the past year has made it possible to overcome serious problems which had been exerting an unfavorable influence on Canadian mining. With many large and promising areas still awaiting development, private enterprise has been largely dependent on government support. An improved taxation program has now been adopted and substantial appropriations are being made for the Canada Geological Survey, as well as for the Mines Departments of the various provinces. Road construction on a large scale is in progress in British Columbia, in Quebec, and in Ontario.

Plane transportation has also done a great deal in assisting the progress of the mining industry. Canadian Airways, servicing many of the mining areas, reports more than 7,000,000 lb. of express carried in the first ten months of 1936. Sioux Lookout, in northern Ontario, is credited with being the world's busiest airport.

Important developments have taken place in each of the mineral areas of the Dominion, only a few of which can be touched on here. In British Columbia there has been a revival of interest in the Bridge River area, where Bralorne and Pioneer are located. Two new properties have announced plans for mill construction in 1937. Additional activity has centered in the Cariboo and Portland Canal areas.

Table II—Canadian Metal Mines Producing in 1936, with Proposed Increases in Milling Capacity

Mining Property	Grade 1936 Dollars Per Ton	Approx. Mill Average 1936	Maximum Tonnage Capacity	Date First Production
ONTARIO				
Algold Mines	....	(l)	100	June, 1936
Algoma Summit (McCarthy-Webb)	14.66	50	500	Mar., 1936
Ardeen (Moss Gold) (g)	8.51	(l)	200	Mar., 1932
Argosy (Casey Summit)	20.27	75	125	July, 1934
Ashley (e) (shut down)	9.30	115	150	Aug., 1932
Barry-Hollinger (shut down)	4.08	100	150	July, 1926
Bidgood Kirkland	13.57	80	150	July, 1934
Bousquet Gold Mines	8.35	60	75	May, 1936
Buffalo Ankerite (aa)	6.85	820	900	June, 1926
Central Patricia Gold Mines	19.69	165	185	June, 1934
Coniaurum (j)	8.15	470	500	May, 1928
Darwin Gold (Grace)	13.14	50	60	Nov., 1935
Deep Lake Gold Mines	22.57	(l)	(l)	1936
Dikdik (McMartin) (g)	14.90	20	25	1934
Dome Mines	13.02	1,535	1,550	1910
Duport (Cameron Island) (j)	91.24	(l)	50	1935
Fox Lake (g)	....	(l)	35	1935
Gillies Lake-Porcupine	11.08	55	100	May, 1935
Gilmour Gold (b) (g)	....	40	100	Sept., 1935
Gold Eagle	....	(l)	100	1936
Gomak Mines (Porcupine Crown)	....	30	50	1936
Halcrow-Swayze (g)	6.49	(l)	25	1935
Harkness-Hays (g)	110.17	(l)	25	Aug., 1935
Hawkins & Canfield	....	(l)	15	1936
Hudson Patricia Gold Mines	....	(l)	50	May, 1936
Hillside Mines	....	(l)	35	Oct., 1936
Hollinger Consolidated	8.00	4,800	7,000	1910
Howey Gold Mines	2.44	1,450	1,500	April, 1930
J-M Consolidated (Jackson-Manion)	12.50	90	100	May, 1934
Kenland Gold (Horseshoe)	....	45	75	1936
Kenora Prospectors & Miners (j)	15.27	(l)	50	1935
Kirkland Lake Gold	8.41	235	250	1919
Lake Shore Mines	17.81	2,425	2,500	1918
Little Long Lac	18.05	235	250	Dec., 1934
Macassa Mines	17.42	200	200	Oct., 1933
Matachewan Consolidated (Canadian Matachewan) (j)	7.70	150	300	Nov., 1934
McIntyre Porcupine	9.76	2,410	2,500	1912
McLaren Porcupine	6.40	(l)	25	July, 1935
McMillan Gold Mines	6.69	110	150	Aug., 1934
McKenzie Red Lake Gold Mines	13.70	150	250	Mar., 1935
Minto Gold Mines	3.86	110	115	June, 1931
Morris Kirkland Gold Mines	....	80	125	Oct., 1936
Naybob Gold Mines (g)	2.21	(l)	40	1935
Northern Empire (Newmont)	16.50	175	200	Mar., 1934
North Shores (Palmer)	16.65	(l)	25	Sept., 1934
Omega Gold (Castle Tretheway)	4.87	310	500	1936
Pamour Porcupine	5.44	550	700	May, 1936
Parkhill Gold	18.83	60	100	July, 1931
Paymaster Consolidated Mines	6.96	385	500	Oct., 1934
Pickle Crow Gold Mines	30.78	135	250	April, 1935
Porcupine United (g)	....	(l)	25	1936
Red Crest (g)	22.00	(l)	10	Feb., 1936
Red Lake Gold Shore Mines	10.59	125	140	1936
Ross (Hollinger)	7.27	75	100	Jan., 1936
Shenango Gold (Oba)	....	(l)	100	May, 1936
Sol d'Or (Rainbow Lake) (g)	....	(l)	50	1936
Stanley Gold Mines	....	35	100	1936
St. Anthony Gold Mines	5.06	90	200	Aug., 1927
Sylvanite Gold Mines	12.69	460	460	July, 1927
Tashota Goldfields (v)	21.00	50	90	April, 1935
Teck-Hughes Gold Mines	11.54	1,160	1,300	1917
Tellaurum (Munro-Croesus)	18.46	(l)	25	1935
Toburn (Tough-Oakes) (i)	20.36	100	125	April, 1913
Vipond (Anglo-Huronian)	4.58	295	300	1911
Wendigo Gold Mines	15.00	50	100	Jan., 1936
Wright-Hargreaves Mines	19.15	1,050	1,100	May, 1921
Young-Davidson Mines	2.73	815	1,000	Sept., 1934
International Nickel Co.	....	12,000	13,500	1916
Falconbridge Nickel Mines	....	1,000	1,250	Feb., 1930
M. J. O'Brien (Cobalt) (t)	....	(l)	250	
M. J. O'Brien (Gowganda) (t)	....	(l)	80	
Chromium Mining & Smelting (k)	....	(l)	100	1935
Phoenix Molybdenite Corporation	....	25	50	July, 1936
QUEBEC				
Arntfield Gold	7.58	165	250	Aug., 1935
Beattie Gold Mines (x)	5.81	1,245	1,500	May, 1933
Bussieres (Treadwell Yukon) (shut down)	....	(l)	150	1932
Canadian Malartic (j)	7.83	160	500	May, 1935
Granada Gold Mines	....	160	500	June, 1930
Greene Stabell (a)	....	70	100	Dec., 1933
Guillet Gold (McIntyre)	....	(l)	100	Aug., 1936
Lamaque (Teck-Hughes)	13.34	250	700	April, 1935
McWatters Gold Mines	21.76	100	150	Sept., 1934
Noranda Mines (a)	7.92	5,250	5,500	Dec., 1927
O'Brien Gold Mines	....	80	150	Sept., 1932
O'Neill Thompson Gold Mines	....	25	35	Aug., 1936
Perron (Mathews)	8.88	170	350	1933
Randall Mines Corp	....	(l)	60	Sept., 1936
Shawkey Gold Mining	11.10	135	180	Mar., 1936
Siscoe Gold Mines	13.48	415	480	Jan., 1929
Stadacona Rouyn Mines	....	150	250	Oct., 1936
Sullivan Consolidated Mines	15.15	150	300	May, 1936
Thompson Cadillac Mining	8.57	70	150	May, 1936
Consol. Copper & Sulphur (Eustis) (c)	....	(l)	200	1865
Tetreault (u)	....	(l)	500	June, 1935
NOVA SCOTIA				
Avon Gold (Oldham)	....	10	100	May, 1936
Banook Mines	....	(l)	25	1934
Beacon Gold	....	10	20	Nov., 1934
Caribou (r)	....	20	20	1934
Corwin Gold	....	(l)	20	1936
Giffin Gold	....	(l)	20	1936
Guysborough Mines (j)	....	75	100	1934
Higgins & Lawlor (Moose River)	....	(l)	20	1933
Hogan, F. J.	....	(l)	20	1936
Lacey (Gold River)	....	25	35	1934
Lake Thomas Syndicate (Waverly)	....	20	100	1935
MacDonald Hudson Gold	....	(l)	20	1934
Montague Gold (s)	....	60	100	May, 1933
Nova Scotia Gold (Tangier)	....	(l)	20	1936
Queens Mining	....	20	50	1935
Salmon River	....	20	20	1934
Seal Harbour Gold Mines	....	20	20	1934
United Gold-fields (Brookfield)	....	25	25	Feb., 1934
Sterling Mines (British Metal) (u)	....	(l)	250	June, 1936
MANITOBA				
Beresford Lake (Oro Grande) (g)	....	(l)	75	July, 1932
Central Manitoba	....	110	150	April, 1927
Cryderman Gold (g)	....	(l)	50	1936
Diana Consolidated Gold Mines (g)	....	30	100	July, 1934
God's Lake Gold Mines	13.65	150	150	Sept., 1935
Gunnar Gold Mines	14.55	145	150	April, 1936
Island Lake Mines (shut down) (j)	....	(l)	50	April, 1934
Laguna (Rex) (e)	....	60	75	Aug., 1936
San Antonio Gold Mines	8.85	300	300	July, 1932
Hudson Bay Mining & Smelting (Flin Flon) (p) (u)	....	4,500	4,600	Sept., 1930
SASKATCHEWAN				
Athona Mines	....	(l)	15	1936
Lake Athabaska (r)	....	(l)	100	1936
NORTHWEST TERRITORIES				
Eldorado Gold (pitchblende-silver) (o)	....	75	150	1933
Bear Exploration & Radium (t)	....	36	50	Oct., 1935
BRITISH COLUMBIA				
Ashloo Gold Mining Syndicate	....	(l)	25	July, 1936
Bayonne Consolidated Gold Mines	....	(l)	50	Nov. 1936
Bralorne (g)	11.49	475	500	Feb., 1932
Caribou Gold Quartz	12.80	110	200	Jan., 1933
Dawson Consolidated Gold (g)	....	(l)	25	1936
Dentonia Mines	....	100	135	April, 1934
Dunwell Mines	....	(l)	30	May, 1934
Fairview Amalgamated Gold Mines	5.16	70	75	1936
Gold Harbor	....	(l)	40	1936
Grandoro Mines	....	(l)	40	1936
Grange (Pavilion Mt.)	....	30	50	Oct., 1934
Hedley Mascot Gold Mines	16.80	(l)	150	May, 1936
Highland-Bell (t)	....	(l)	....	1930
Island Mt. (Newmont)	14.20	90	150	Nov., 1934
Home Gold	....	(l)	25	1936
Jenny Long Gold	....	(l)	30	1936
Kamloop Homestake	....	(l)	75	1936
Kelowna (Nickel Plate) (s)	....	200	225	1934
Kootenay Belle (f) (u)	....	50	100	Dec., 1934
Meridian (shut down)	....	115	125	1935
Minto Gold	....	110	125	Dec., 1934
Morning Star (Fairview)	....	30	75	Sept., 1935
Nicola Mines (d)	....	65	100	1929
Northern Mines	....	(l)	15	1936
Osoyoos Mines	16.45	(l)	40	Oct., 1935
Pioneer Gold of B. C.	....	350	400	1928
Premier Gold Mining (m)	....	400	600	1919
Precambrian Gold	....	(l)	30	1936
Relief-Arlington (h)	14.34	40	75	1933
Reno Gold Mines	22.78	125	150	Aug., 1929
Sheep Creek (Queens) (n)	11.63	125	150	May, 1935
Superior (Providence) (g)	....	(l)	50	Oct., 1934
Surf Inlet Consolidated Gold Mines	15.89	30	400	April, 1936
Surf Point (N. A. Trimmins) (g)	....	18	25	1934
Taylor Windfall Gold Mining	....	(l)	10	1936
Twin Lakes Gold	....	(l)	40	1936
Two Star	....	(l)	50	1935
Union Mining & Milling (Hecla)	....	(l)	200	1933
Vidette Gold Mines (a)	....	35	75	Dec., 1933
Velvet Gold Mining Co. (a)	....	(l)	100	1932
Wayside Cons. Gold (shut down)	....	25	100	Nov., 1934
Windpass Gold	....	40	50	Jan., 1934
Wesko Mines (Central Star)	....	90	100	Nov., 1936
Wilcox Mining Syndicate	16.50	12	20	1934
Ymir Cons. Gold (Goodenough)	....	65	100	July, 1935
Ymir Yankee Girl Gold Mines	12.00	100	150	July, 1934
Consolidated Mining & Smelting (Kimberley) (u)	....	....	6,600	
Consolidated Mining & Smelting (Tadanac) (a)	....	....	2,400	
Brittania Mining & Smelting (a) (u) (w)	....	....	5,000	
Noble Five Mines (Slocan) (u) (y)	....	....	100	

(a) Copper-gold producer. (b) Produced $24,348 up to 1914. (c) Continuous operation since 1879; copper and sulphur concentrates shipped to United States. (d) Intermittent operation in 1929, 1930 and 1934. Resumed in August, 1935. (e) Controlled by Mining Corporation of Canada. (f) Production of $83,986 prior to 1909; again active 1927-28. (g) Production temporarily suspended. (h) Premier holds 52% interest. (i) Controlled by Premier Gold Mining Company. (j) Controlled by Ventures, Ltd. (k) A fourth furnace being added to Sault Ste. Marie smelter, where concentrates are treated. (l) Not reported. (m) Canada's second largest silver producer. (n) Formerly produced $1,300,000, 1909-1916. (o) Monthly output approximately 80,000 oz. silver, 4 grams radium. (p) Copper-zinc-gold producer. (q) Also treating ore from Bradian mine. (r) Controlled by Consolidated Mining & Smelting. (s) Formerly largest British Columbia gold producer. (t) Silver producer. (u) Gold-silver-lead-zinc producer. (v) Controlled by Minefinders Limited. (w) Controlled by Howe Sound Company. (x) Controlled by Nipissing Mines. (y) Former production $700,000; reopened August, 1935. (z) Controlled by Noranda Mines, Ltd. (aa) Combined with Marbuan, formerly March Gold Mines.

CANADA

In Saskatchewan, mining developments are in progress at Lake Athabaska, where, in addition to gold, an important find of nickel-copper ore was made in 1936. This province supplies all Canadian requirements for sodium sulphate, used by pulp and paper mills and for refining nickel.

In Manitoba there are seven producing gold mines and two more that are shut down for the time being.

Ontario's gold production, valued at $161,535,000, compared with $142,888,565 in 1935, was higher in 1936 than ever before. There are 67 gold mines and 6 producers of other metals in the province. Chief interest has centered on the very large orebodies developed at Madsen Red Lake, where construction of a 1,000-ton mill in 1937 is discussed. Important developments have been taking place at Macassa, Coniaurum, Hard Rock, Little Long Lac, Cline, and in many other areas. Both Kirkland Lake and Porcupine are spreading out to the east, following encouraging discoveries at the Pamour and Bidgood mines. Central Patricia and Pickle Crow are now at the center of a growing camp located 100 miles north of the railroad.

In Quebec even greater expansion has taken place, with a 41 per cent jump in gold output for 1936 and prospects of still further increases in 1937. One of the major developments of 1936 in Canadian mining was the discovery of a block of high-grade ore at the O'Brien mine, in Cadillac Township. This touched off a boom that extends over into Bousquet and Malartic townships, where numerous properties are now being explored. The area is soon to be opened up by a 100-mile branch of the Canadian National Railway, running from Rouyn to Senneterre.

Development work has been proceeding at the Chibougamau property of the Consolidated Mining & Smelting Company, and a road 175 miles long is under construction to connect this camp with the railroad. Four new gold producers are scheduled to start mill construction in Quebec, with several others in prospect before the end of 1937.

Forty-two mining companies paid dividends in 1936 amounting to $80,950,180, which marks another all-time record and compares with $59,364,889 paid by 31 companies in 1935. These figures do not include dividends disbursed by three other Canadian companies, Lava Cap, Bulolo Gold Dredging, and International Mining, which operate mines outside the country. Eleven companies paid initial dividends in 1936 and fifteen others made disbursements larger than in the preceding year. International Nickel leads all other metal mines in Canada in total dividends paid during the year, with common and preferred stockholders receiving $20,893,151. Lake Shore took second place by distributing $10,000,000, followed by Noranda with $6,719,316 and the Consolidated Mining & Smelting Company with $6,515,257. Hollinger made dividend disbursements of $5,412,000, Wright-Hargreaves paid $3,300,000, and Teck-Hughes $2,163,215. Others contributing more than $1,000,000 to the impressive total were Hudson Bay, McIntyre, Falconbridge, Howe Sound, Granby, and Pioneer of B. C. Present indications are that dividends in 1937 will exceed $100,000,000.

Table III—Dividends Paid by Canadian Mines, 1932-1936 *

Mining Company	1932	1933	1934	1935	1936
Anglo-Huronian	.....	.....	0.40	0.20	0.40
Beattie Gold	.....	.....	.....	.....	0.05
Beaverdell Wellington Syndicate	0.10	0.10	0.10	1.00	.....
Bralorne Mines	.....	.....	0.62½	0.30	0.45
Buffalo-Ankerite	0.05	0.08	0.16	0.20	0.20
Cariboo Gold Quartz	.....	.....	.....	.....	0.10
Central Patricia	.....	.....	.....	.....	0.08
Coniagas Mines	.....	0.12½	0.12½	0.12½	0.12½
Consolidated Mining & Smelting	.....	10%	3.00	6.50	(h)2.00
Dome Mines (d) (e)	1.30	1.80	3.50	4.00	4.00
Falconbridge	.....	0.25	0.27½	0.30	0.30
Granby Consolidated (g)	0.12½	.....	.....	5.00	10.00
Highland-Bell	0.03	0.07	0.15	0.17	0.07
Hollinger Consolidated	0.75	0.85	1.40	0.90	1.10
Howe Sound (a) (e)	0.95	1.30	3.00	4.05	3.10
Howey Gold Mines	.....	.....	0.10	0.05	0.02
Hudson Bay Mining Smelting	.....	.....	.....	1.00	1.00
International Mining (e)	0.07½	0.15	0.15	0.65	0.45
International Nickel (c) (e)	.....	.....	0.50	0.75	1.30
Island Mountain	.....	.....	.....	.....	0.10
Kerr Lake Mines (b)	.....	.....	0.10	0.10	0.05
Kirkland Lake Gold	.....	.....	0.03	0.03	0.06
Lake Shore	3.00	3.00	3.50	4.00	5.00
Little Long Lac	.....	.....	.....	.....	0.30
Macassa Mines	.....	.....	0.05	0.15	0.15
McIntyre Porcupine (d) (e)	1.25	1.87½	2.00	2.00	2.00
McKenzie Red Lake	.....	.....	.....	.....	0.07
McKinley Mines Sec. (f)	.....	.....	0.02½	0.05	0.05
McWatters Gold	.....	.....	.....	0.05	0.10
Nipissing Mines (e)	.....	.....	0.12½	0.12½	0.50
Noranda Mines	1.10	1.50	2.00	2.00	3.00
Northern Canada Mining	.....	.....	.....	0.02	0.04
Northern Empire Mines (i)	.....	.....	.....	0.50	.....
Pickle Crow Gold	.....	.....	.....	.....	0.20
Pioneer of B. C.	0.12	0.42	0.65	0.80	0.80
Premier Gold	0.12	0.12	0.12	0.13	0.16
Reno Gold	.....	.....	.....	0.14	0.12
San Antonio	.....	.....	0.05	0.21	0.14
Sheep Creek	.....	.....	.....	.....	0.04
Siscoe Gold	0.11	0.14	0.19	0.21	0.21
Sudbury Basin	.....	.....	.....	.....	0.10
Sylvanite Gold (e)	0.05	0.05	0.25	0.20	0.20
Teck-Hughes	0.60	0.60	0.55	0.40	0.45
Thompson Joanne (f)	.....	.....	.....	3.50	7.00
Toburn	.....	.....	0.08	0.08	0.08
Ventures	.....	.....	.....	.....	0.02½
Wright-Hargreaves (e)	0.20	0.27½	0.55	0.60	0.60
Ymir Yankee Girl	.....	.....	.....	.....	0.05

(a) Controlling mines in British Columbia and Mexico. (b) Controlling mines in Canada, United States, New Zealand, Australia. (c) On preferred stock a 7 per cent cumulative dividend has been maintained since reorganization in 1929. (d) Plus tax on United States funds. (e) Paid in United States funds. (f) Holding company. (g) Capital distribution; plant and property sold to Consolidated Mining & Smelting. (h) Par value of $25 per share reduced to $5 in 1936. (i) Controlled by Newmont Mining Corporation. (j) Data compiled by *Mining Analyst*.

Table IV—Cumulative Dividend Record of Canadian Metal Mines (a)

Province and District	1932	1933	1934	1935	1936	Total to End of 1936
ONTARIO:						
Sudbury	$1,933,909	$2,746,509	$10,125,156	$13,866,659	$21,894,233	$193,976,404
Cobalt (c)	.....	97,769	245,790	150,000	600,000	106,538,443
Porcupine	6,007,758	7,436,827	11,910,041	9,952,883	11,021,672	132,951,249
Kirkland Lake	10,011,761	10,561,762	13,930,381	14,584,641	16,989,820	100,756,099
Patricia	.....	.....	500,000	420,500	1,652,902	2,573,402
BRITISH COLUMBIA	$2,988,888	$3,075,572	$6,762,820	$11,147,258	$16,627,103	$155,970,882
QUEBEC	2,964,370	4,004,203	5,355,505	5,544,898	8,112,890	32,697,747
MANITOBA	.....	.....	112,023	3,228,734	3,082,180	6,422,936
NOVA SCOTIA (b)	.....	.....	.....	.....	.....	47,928
MISCELLANEOUS	.....	.....	529,138	471,816	969,381	1,970,336
Totals	$23,906,686	$27,922,642	$49,470,854	$59,367,389	$80,950,180	$733,905,425

(a) Data compiled by *Northern Miner*. (b) Paid in 1900; dividend record incomplete.
(c) Since 1933, paid by Nipissing Mines, a holding company.

UNITED STATES

Non-ferrous Mining Gains, Thanks To Higher Metal Prices

H. C. Chellson
Assistant Editor

THE barometer of metal prices rose to higher levels in 1936. Consequently, mining districts became more active, employment gained, labor strikes occurred and were settled, wages rose, and the mining industry started to contribute its share to a broader industrial recovery.

The unchanged price of gold and domestic silver added courage to reopen marginal deposits that might be profitably operated as soon as base-metal prices reached a satisfactory level. Industrial recovery consumed more copper, lead, and zinc, and stocks of these metals were reduced during the course of the year. Fortified by such circumstances and believing the price structure of base metals to be sound, smaller mine operators rehabilitated their properties and started up production. Employment in the mining industries showed a steady monthly climb throughout the year. Basing 110,000 persons employed in 1929 the Department of Labor shows that in January, 1936, employment stood at 54.2 per cent and at 64.2 in October. The average weekly payroll in 1929 was $3,279,000 and on January last year this index was 41.7 per cent and in November 54.6 per cent, or an increase of almost 13 per cent. Labor troubles in Montana, Utah, and New Mexico were settled and the year closed with copper reaching 12c on Dec. 31.

The Reconstruction Finance Corporation last year loaned $2,842,500 to applicants for mining loans. This amount included $940,500 authorized prior to 1936. Total repayment of loans to the R.F.C. as of Dec. 31, 1936, amounted to $495,000. No repayments had been made prior to this time. During eleven months of 1936 there were 37 S.E.C. registrations of gold and silver mining issues, totaling $27,825,000.

Production of gold in 1936 was about 4,000,000 oz. compared to 3,000,000 oz. in 1935. The Homestake mine, at Lead, S. D., produced more gold in 1936 than in any other year in its 60-year history. The country's silver production amounted to 11,000,000 oz. compared to 10,000,000 oz. in 1935. The Sunshine mine, in Idaho, made a record in its silver production and continues to be the country's largest silver producer.

Copper production was stepped up at most of the large mines in the last quarter of the year, and some mines, closed for several years, were reopened when copper prices reached satisfactory levels. Table I shows the upward trend of production and apparent consumption (deliveries) of copper during 1936.

Mine production of lead from domestic ores is estimated to be about 381,600 tons in 1936 compared to 310,505 tons in the previous year. Due to greater consumption, lead stocks decreased and the price rose, encouraging greater output among most producers. The trend of production (refinery) in relation to consumption during 1936 is told in Table II.

In 1936 there was a marked improvement in the zinc industry. Stocks at the close of the year were low, and, influenced by higher prices abroad, the price here rose to a more profitable level. In the last quarter there was great activity in the Tri-State and in other zinc-producing regions. A picture of zinc production and shipments of metal to consumers during 1936 is shown in the Table III.

ARIZONA ▶ Production of all non-ferrous metals increased in the "Apache" State during 1936. Copper mined totaled 205,000 tons, a new record was set in gold and silver output, and there was a substantial increase

Table I

United States Duty-Free Copper Statistics

Copper Institute

In Short Tons

Year	Production — Mine and Custom Intake	Production — Refined	Deliveries — Domestic	Deliveries — Export	Deliveries — Totals	(a) Stocks, Refined, End of
1933	.....	.....	.....	.....	.....	523,435
1934	360,534	336,710	379,843	125,866	505,709	354,436
1935	506,085	496,658	528,194	91,485	619,679	231,415
1936:						
January	57,201	55,845	54,390	1,982	56,372	230,888
February	52,303	54,451	51,417	3,630	55,047	230,292
March	57,574	67,147	56,448	2,287	58,735	238,704
April	61,560	58,801	59,704	3,874	63,578	233,927
May	62,100	59,374	59,906	3,090	62,996	230,305
June	55,960	60,562	57,149	4,901	62,050	228,817
July	50,420	53,985	59,807	4,290	64,097	218,705
August	51,961	55,410	64,140	4,239	68,379	205,736
September	66,842	62,655	75,892	3,780	79,672	188,719
October	72,074	72,895	75,919	7,677	83,596	178,018
November	73,978	68,682	67,379	8,030	75,409	171,291
December	70,349	78,829	82,409	6,667	89,076	161,044
Totals	732,322	748,636	764,560	54,447	819,007	

(a) Refined stock at refineries, on consignment, and in Commodity Exchange warehouses. Does not include consumers' stocks at their plants or warehouses.

Table II

United States Production, Shipments, and Stocks of Lead in 1936

Refinery Statistics in Short Tons

(*American Bureau of Metal Statistics*)

Year	Production	Domestic Shipments(a)	Stock at End
1934	412,298	379,807	235,457
1935	421,764	433,456	222,306
1936:			
January	36,296	34,590	224,013
February	34,127	33,086	225,010
March	35,150	36,743	223,388
April	38,073	40,457	220,991
May	41,551	33,125	229,409
June	38,818	37,736	230,481
July	39,576	38,996	231,081
August	33,542	46,388	218,233
September	32,982	50,685	200,517
October	42,156	59,210	183,430
November	43,625	50,153	176,914
December	47,085	51,646	172,423
Totals	463,187	512,975	

(a) Includes secondary and foreign, which totaled 31,234 in 1936.

Table III

United States Production, Shipments and Stock of Zinc (All Grades) in 1936

In Short Tons

(*American Zinc Institute*)

Year	Production	Shipments	Stock at End
1934	366,933	352,663	119,830
1935	431,499	465,746	83,758
1936:			
January	41,917	46,468	79,207
February	36,228	39,918	75,517
March	42,483	38,159	79,841
April	43,252	42,311	80,782
May	44,905	43,977	81,710
June	44,947	41,654	85,003
July	45,553	41,891	88,665
August	43,614	46,085	86,194
September	42,283	51,847	76,630
October	46,297	54,035	68,892
November	45,742	57,107	57,527
December	47,050	59,821	44,756
Totals	524,271	563,273	

UNITED STATES

in lead. The copper mines of the Phelps Dodge Corporation accounted for almost half of the State's 310,000 oz. of gold produced last year. United Verde, Copper Queen, New Cornelia, Tom Reed, Pioneer Gold Mining, Shattuck-Denn, Gold Standard, Hammoth-St. Anthony, Pioneer, Tennessee-Schuylkill, and the Lynx Creek dredge also stepped up gold production during the year.

Most of the silver produced was derived from copper ore from the Copper Queen, United Verde, New Cornelia, and Magma mines. These properties accounted for about 6,000,000 oz. of the 8,125,000 oz. produced during the year.

Copper mines boosted production almost 70,000 tons above the 1935 record. All producers help to account for this increase and the Inspiration and Miami mines, in the Globe district, followed by the Ajo district, led in this figure.

The Eagle-Picher Mining & Smelting Company continued to be the leading lead producer in the State. The "79" mine and the Tennessee-Schuylkill, near Chloride, which opened during the year, accounted for some of the higher lead column. Other important lead producers were the Gold Canyon Mining Company, Shattuck-Denn, Hillside, Flux, Tombstone, and Copper Queen mines.

Numerous small operators sent their ore to a new custom plant at Chloride and several company mills took custom ore. The Bagdad Copper mine, at Hillside, resumed operations and gradually stepped up production. Manganese claims in the Artillery Mountains were extensively prospected. The United States Smelting & Refining Company built a 300-ton mill at the Gold Roads mine, near Oatman. American Metal did some drilling on zinc deposits near Tombstone.

CALIFORNIA ▶ The state marched farther from the depression last year and produced the most gold since 1916. Working mines expanded and many prospects in 1935 became producers in 1936. Lode mining is estimated to account for about 60 per cent of the 1,049,600 oz. of gold produced during the year, the remainder being supplied from dredging operations. The Grass Valley-Nevada City, Mother Lode, and Mojave districts were the high spots in gold production. Considerable testing of placer areas was done during the year and in 1937 several new dredges will be placed in operation, adding to the 63 that operated in 1936.

A higher silver output followed the high gold yield. The growing Mojave district was the chief supplier of silver and the Golden Queen Mining Company, for the first time in its young career, became the State's premier silver producer. The increased copper output is accounted for by the Walker mine, which stepped up production to 5,000 tons daily. The bulk of the lead came from the Cerro Gordo district, in Inyo County, and the Blue Light mine, in Orange County, produced most of the zinc.

COLORADO ▶ A sign of better times in Colorado mining, besides the increased metal production, is found in the decreasing number of small-scale placer miners. The Bureau of Mines reports that 967 were operating in 1934, 842 in 1935, and estimates 700 in 1936. Expanding operations in mining districts are believed to have attracted these small operators to jobs in the mines or mills. Gold and zinc production in 1936 was a little above the figures for 1935 (see table), but the outputs of silver, copper and lead were in good volume compared to previous years. The Cripple Creek district accounted for the largest production of gold. Good ore was found below the Roosevelt drainage tunnel level in the Ajax and Cresson mines and high-grade ore was developed between the 20 and 21 levels in the Vindicator mine. Operators consider that the facts noted constitute important data for determining the practicability of the proposal for constructing a deeper drainage tunnel in the Cripple Creek district.

The Leadville region accounted for the greatest part of lead and zinc produced during the year. In San Juan County a 3,000-ft. haulage tunnel (now in about 800 ft.) is being driven, under contract, for the American Smelting & Refining Company by the Shenandoah-Dives Mining Company to the Silver Lake group of mines. A court decision in 1935 forcing companies to build tailings dams presented problems at some properties but were generally solved. St. Joe Mining & Milling Company, however, was forced to construct a new mill at Valmont, near Boulder, to conform to this law.

IDAHO ▶ Output of gold declined in Idaho for the second consecutive year. The decrease in 1936 was due chiefly to the closing in May of the Boise-Rochester property, near Atlanta, according to the Bureau of Mines. Silver production was the highest in the history of the State. The 1936 output is estimated at 14,400,000 oz., of which the Sunshine Mining Company produced about 9,031,000 oz. from 200,000 tons of ore, compared to 5,876,908 oz. in 1935.

Copper production increased, due mainly to a greater production of silver-lead and lead-zinc ore containing small amounts of copper. Increased demand for lead accounted for a higher production from Bunker Hill & Sullivan, Star, Page, Triumph, Sidney, and Hecla mines. The Bureau of Mines breaks down the production as 73 per cent of the lead coming from lead-zinc ores and the remainder from lead ore mines, with the Bunker Hill & Sullivan, Morning, and Hecla mines totaling about 80 per cent of the State's output.

Mines in the Coeur d'Alene region produced the bulk of the zinc, and the leader was Morning mine of the Federal Mining & Smelting Company. The electrolytic zinc plant operated by the Sullivan company produced at capacity throughout the year. Hecla Mining Company started construction of a 750-ton mill for the Star mine.

UTAH ▶ The three important mining districts, Bingham, Tintic, and Park City, contributed in 1936 a 53 per cent increase over Utah's 1935 metal production. Most of the gold came from the Bingham district, which produced almost 150,000 oz. The Tintic district followed with about 41,000 oz. Total gold output was approximately 225,000 oz., compared to 184,-

838 in 1935. Silver production totaled 10,115,000 oz. as against 9,227,673 in 1935. The mines of United States Smelting, Refining & Mining were the largest producers of silver in 1936, followed by Tintic Standard, Silver King Coalition, Utah Copper, Park City Consolidated, and Park Utah Consolidated. The Bureau of Mines estimates that about 55 per cent of the silver came from lead-zinc ores mined in the State.

Output of copper was the greatest since 1929, and Utah copper producers more than doubled their 1935 output. As a consequence, the Arthur mill, closed since Jan. 25, 1930, was reopened on Sep. 15.

Lead production from the Bingham district reflected a decrease, due to the two months' labor strike. Total lead production for the State, however, was 67,930 tons in 1936, compared to 63,525 tons in 1935. About 80 per cent of the lead came from lead-zinc ore treated by flotation and most of the remainder was lead ore of smelting grade. The United States and Lark group of United States Smelting, Refining & Mining, as in the past, was the largest lead producer.

Zinc output was also curtailed by the labor strike, but the Judge mine of the Park Utah Consolidated boosted its production substantially and helped in part to make up the loss.

Early in 1936 Tintic Standard bought control of the Chief Consolidated Mining Company. The labor strike in Utah lasted from Oct. 12 to Dec. 16 after virtually shutting off production of non-ferrous ores, except at the mine of Utah Copper. The Lakeside Monarch Mining Company started the erection of a 100-ton mill on the west side of Great Salt Lake 17 miles north of Delle, for the treating of lead ore said to assay 15 per cent lead. Plans for a vehicular tunnel through West Mountain were announced by Utah Copper late in the year. It will maintain traffic between Copperfield and Bingham while mining operations continue undisturbed.

UNITED STATES

MONTANA ▶ The value of mineral output in Montana increased about 35 per cent in 1936 over that for 1935. All metals except zinc showed an increase. Higher gold production was accounted for by two dredges that were in constant operation, one by the Porter Brothers Corporation at Helena and the other a dry-land dredge of the Humphreys Gold Corporation of Virginia City. Small gold-dredging operations and output from lode mines added their share. Greater expansion by small operators in the siliceous gold properties was reflected in the higher shipments to custom plants. Silver output was 11,235,000 oz. in 1936, an increase over the 9,322,951 oz. that were produced in 1935.

Lead-zinc ore from the Orphan Girl and Emma mines, operated by Anaconda, and the Jack Waite, Comet, and Trout Mines yielded about 85 per cent of the total lead output.

Copper produced was 109,309 tons in 1936, a substantial increase over the 77,479 produced in 1935. Anaconda accounted for most of this output. The Bureau of Mines reports that the company reopened the sand-leaching plant at Anaconda and re-treated several hundred thousand tons of old copper tailings by a combination of acid-leaching and flotation.

Lack of hydro-electric power, due to drought conditions, forced curtailment of electrolytic zinc production from the Anaconda plant.

NEVADA ▶ An achievement in 1936 was an 83 per cent increase in copper production, whereas zinc output was only 2 per cent higher and lead production was down 3 per cent compared with the record for 1935. Gold was principally derived from lode mines containing dry and siliceous ore. Greater output from Nevada Consolidated Copper Corporation's property accounted for more gold from copper ores. Silver was derived mostly from gold and lead and zinc ores and production from the major copper producers. The two principal copper producers were Nevada Consolidated Copper Corporation and Mountain City Copper Company (a subsidiary of Anaconda Copper Mining Company). Lead production fell off, due to curtailment of operations at the Tybo mine. Production of lead from the Pioche district was, however, above that for 1935. This district was responsible for a greater output of zinc.

The State's mining history recorded another gold strike. This time it was in the Awakening district, in the Slumbering Hills, where prospectors developed a rich gold prospect into a small, well-paying mining enterprise known as the Jumbo. The deepest workings are now about 150 ft.

Mines in the Pioche district are preparing for greater production and lower operating costs are anticipated when electrical energy from Boulder Dam is supplied during the summer months.

Zinc production from the State of Washington was materially increased by the reopening of the Pend Oreille Mines & Metals Company at Metalline Falls. Production of lead and zinc decreased in New Mexico in 1936 due to a miners' strike that lasted more than two months at the Pecos mine, San Miguel County.

Table IV — United States Production of Gold, Silver, Copper, Lead and Zinc

(United States Bureau of Mines)

Mine production of metals in 1935 and 1936 in terms of the recovered and recoverable metal in ounces and short tons. Figures for 1936 estimated.

Western States	Gold, Oz.		Silver, Oz.		Copper, Tons		Lead, Tons		Zinc, Tons	
	1935	1936	1935	1936	1935	1936	1935	1936	1935	1936
Arizona	241,754	310,000	6,601,280	8,125,000	139,014	204,600	7,784	10,138	3,336	3,950
California	890,430	1,049,600	1,191,112	2,026,700	983	5,160	567	745	161	20
Colorado	349,281	364,713	4,696,064	5,814,119	7,327	8,789	5,673	6,829	1,202	1,256
Idaho	83,823	80,023	10,240,953	14,400,000	1,048	1,425	79,020	90,200	31,053	46,250
Montana	151,088	179,000	9,322,951	11,235,000	77,479	109,309	15,589	18,661	54,781	49,410
Nevada	184,940	284,700	4,359,300	4,970,000	38,121	67,825	12,652	12,305	15,660	15,785
New Mexico	33,435	33,298	1,061,902	1,141,000	2,253	3,309	7,289	7,154	22,126	20,776
Oregon	54,160	59,900	110,385	83,800	199	270	30	80	.....	45
South Dakota	567,230	590,679	151,047	135,600	.....	.....	4	.....	.....	.....
Texas	518	675	1,000,960	1,383,000	14	26	521	525	.....	.....
Utah	184,838	224,500	9,227,673	10,115,000	64,765	126,645	63,525	67,930	31,157	34,180
Washington	9,740	11,400	52,338	58,000	43	25	103	895	1	4,315
Wyoming	3,715	2,180	1,152	1,217	1	.....	3	.....	.....	.....
Central States										
Arkansas	.....	.....	.....	.....	.....	.....	38	30	153	180
Illinois	.....	.....	3,147	1,600	.....	.....	436	230	.....	.....
Kansas	.....	.....	.....	.....	.....	.....	10,892	11,120	54,110	78,820
Kentucky	.....	.....	.....	.....	.....	*	132	35	127	125
Michigan	.....	.....	4,219	*	32,054	48,300	.....	*	.....	.....
Missouri	.....	.....	110,551	163,724	34	.....	97,493	109,340	7,263	18,740
Oklahoma	.....	.....	.....	.....	.....	.....	23,405	24,450	129,763	125,120
Wisconsin	.....	.....	.....	.....	.....	.....	286	730	8,923	7,660
Eastern States	9,491	9,558	83,975	86,268	10,407	10,900	4,982	6,230	158,260	169,540
Alaska	470,116	530,000	286,600	454,000	.....	16,290	815	1,730	.....	.....
Totals	3,234,559	3,730,226	48,505,609	60,194,028	373,742	619,163	331,239	369,357	518,076	576,172

*Figures for 1936 not available.

MEXICO

Economic Reform Program Hampers Mining Operations

A. H. Hubbell
Associate Editor

CERTAIN FACTS still spell undeniable prosperity[1] for Mexico, in spite of labor troubles—its record foreign trade, to which both exports and imports contribute, with the balance in the country's favor; the ascending scale of business; the excellent position of the banks; the great increase in freight and passenger traffic on the National Railways, at times so heavy as to tax the rail facilities; the growing income of the Government; the tourist, who, with his spending money, comes in ever increasing numbers, his visit facilitated by new highways and his stay made pleasanter by the fact that his presence is desired; the consumption of electric power, so large that a definite power shortage looms; the rise in commodity prices without decrease in consumption; and the great amount of construction work that is under way, embracing important public works of varied kinds.

Chief among the underlying causes of this prosperity remain the current exchange rate of 3.60 pesos to the dollar, which has exerted its stimulating effect ever since the old, long-established rate of two pesos to the dollar was abandoned in 1933, when the United States went off gold, and in which rate no present change is contemplated; and the Government's program of social reform—beneficent at present to the peon but hard on those with whose interests it conflicts. This program was dealt with in some detail in the issue[1] of *E.&M.J.*, February, 1936.

Parallel with this prosperity and growing out of it, with its roots in the reform program, is Mexico's labor trouble, which affects all industries, particularly those engaged in exploiting the natural resources of the country, the latter circumstance arising from the economic beliefs of the regime in power. Mining and metallurgical labor's organization under the Sindicate, the strength it has under the Labor Law, the support it receives from the Government and the reasons for that support; its wage scale and hours of work—have all been previously discussed[1] at length. One may repeat, however, that the Government's prime objective is to improve the status of the working man. Nothing apparently is to be allowed to thwart this effort. Hence arbitrary action when such seems necessary. Hence also the mining executive's headaches when labor blandly scraps its contracts and asks that new ones be drawn.

Mitigating these troubles somewhat is the continuance of the favorable exchange and the fact that the production of gold, silver, lead and zinc has improved; and likewise the prices of the base metals, although silver, Mexico's premier metal, brought less than in the year before and the price of gold remains unchanged. It is interesting to note that the fall in silver price led the Government in September to restore the silver money in use to 72 per cent fineness, reversing its decree of the year before which authorized the paper one-peso note and the 50-centavo silver-piece, 42 per cent fine. Compared with 1935 the production of silver rose approximately 3¼ per cent, that of gold 14½ per cent, lead 13 per cent and zinc 10 per cent. The output of copper fell 17 per cent, although the price improved. The base metals, it should be remembered, sold as they are on the London basis, brought the producer less than the respective New York prices, averaged for the year.

Production facts, such as these, become paler in significance when mines and smelters close because of strikes. And Mexico's mining industry saw many strikes in 1936 and others narrowly averted because of concessions granted. Of special interest because of circumstances was the closing of mines and plants in several important camps when workers of the power company that supplies Mexico City and the adjacent region struck. To provide the employees of the companies forced to close by lack of power, with funds on which to live, these power-consuming companies, which were in no way responsible for the strike but were rather the victims of it, were requested by the authorities to pay their workmen, despite the latter's idleness. This the industrialists of the capital were forced to do, and report has it that the mining interests are now being sued to compel compliance.

Important from the operator's viewpoint was the decree that workers must be paid full wages for the obligatory weekly day of rest. Another feature of the situation is the *escalafon*, by virtue of which employees must be promoted according to seniority instead of relative competence, so that even important positions must be filled in this manner, whether or not competent persons are next in line—a procedure that must surely be unwelcome to the intelligent and capable employee.

As a result of the constant pressure for higher income for the workman, many collective contracts were perforce revised during the year and substantial increases made in wages. The average amount paid employees in the mining industry in 1936 increased 38 per cent, it is estimated, over the average of 1,204.91 pesos paid in 1935. The newly ordained payment for the day of rest alone caused an increase in the average wage of 16.7 per cent. Though wage scales are supposedly based on the legal minimum or "living" wage, established for each district by the local Minimum Wage Board—and this board, composed of residents of the district, is supposedly familiar with the cost of living locally—it should again be emphasized that the principal operators, who give employment to the larger part of the labor employed in mining in the Republic, start their scales at a minimum that is about three times the legal figure. The reader who thinks he knows something of conditions in the United States must not make the mistake of calculating the dollar equivalent of pesos paid as wages and judging accordingly as to the welfare today of the recipient. The relative cost of living must be known before a proper comparison can be made between two districts or between two countries. In addition to his wages, the workman enjoys various privileges such as rest days, already mentioned, and certain holidays and annual vacations, all with pay. Many companies, moreover, are providing better housing for their employees and erecting and maintaining schools. Rome, it should be recalled, was not built in a day.

Related to the labor question, though quite different in its aspects, is the problem of the shrinking staffs of skilled employees. The number of competent and experienced mine, mill,

[1] See "The Mining Industry South of the Rio Grande," *E. & M. J.*, Feb., 1936.

MEXICO

and office men is known to be decreasing rapidly, due to their departure for other posts abroad, as is so frequently the case with mining men. They may freely go, but, immigration restrictions being much more severe than formerly, they find it difficult if not impossible to return, nor can others enter from abroad, save as visitors, unless they happen to be citizens of the country, or come in under contract to manage a property and to remain with the one company, or else enter with permission to do special work for a limited period of time. Under the Immigration Law no foreigner can enter Mexico to work unless the Secretariat of National Economy grants a certificate of "unsubstitutibility," meaning that there is no Mexican who is properly trained to perform the duties. A factor in this

situation also is the attitude of Labor whereby the collective contracts drawn are encroaching more and more on the limited list of so-called confidential employees whom the Labor Law exempts from the obligation of belonging to the union. This law, moreover, provides that all enterprises must select at least 90 per cent of their personnel among Mexicans. Whether this is a healthy situation remains to be seen. Much of Mexico's future mining activities must inevitably depend on its low-grade resources, which will require not only heavy capital investment but also the best technical brains obtainable, whether they come from within the country or from abroad.

New legislation, both actual and proposed, having to do with other than Labor matters, has during 1936 given all concerned with mining in the southern Republic something to think about. Late in November a new Federal law, the Law of Expropriation, became effective. It lists twelve "causes of public utility" that constitute sufficient grounds for expropriation. Of these, we may quote one (No. 7), which reads: "The defense, conservation, development, or the taking advantage of natural elements susceptible of exploitation." As officially stated, the law "tends to expropriate the sources of production that are inactive. In the case of an idle industrial enterprise, the Government has to find a way to put it to work and then is when the Law applies and when the time for payment of the expropriated industry is decided, on the conditions set by the same law." The law has not been concretely applied, but it is interpreted by some as a threat to any company which fails to come to an agreement in protracted labor disputes. At the moment, it is said to be aimed at farm lands which are being redistributed. Successful here, it may be applied elsewhere, possibly encouraging the confiscation of mining properties or of power companies that supply the mines. These possibilities, it would seem, may subsequently prove deterrents where new capital investments are under consideration. At present, new mining investment is so small as to be negligible. Proposal of a new mining law granting unusual power to the President to legislate on mining and other matters has elicited much discussion. One of its articles calls for the reinvestment within the country of 25 per cent of a mining company's profits, a provision that is to be retroactive in application. The manner of investment—a matter of importance—is not specified. And rumor has it that re-investment in the same general district may be prohibited, a hardship if true. Another article of the proposed law prescribes a minimum royalty of 5 per cent on the gross revenue of operators, but whether this is to take the place of the production tax is unknown as yet. The contemplated law provides also that metallurgical plants must reserve 25 per cent of their capacity for possible use by outside producers. All of which furnishes a fertile field for speculation.

Taxation in its various forms remains largely as described in detail in the article published in the issue of February, 1936. One change—an upward one—was made in the so-called absentee tax, which is that levied on money sent out of the country, it being modified to the extent of raising the levy on dividends from 2 to 4 per cent. Those who may have hoped that the decline in the price of silver would elicit greater leniency from the Government, in view of that metal's importance in the national economy, were disappointed. The special decree taxing silver, which was issued in April, 1935, when the price seemed about to rocket to dizzy heights, established a sliding scale based on the price of the metal, so that provision was made for a drop as well as a rise in price, evidencing foresight rather than leniency. The production tax on metals, which in the case of refined silver is levied at the rate of 6.76 pesos per kilogram and is in addition to the special tax just mentioned, remained as tabulated[2] in the article of February, 1936.

Tariff schedules covering mining and metallurgical machinery imported into Mexico remain essentially unchanged. Equipment of this sort, aside from such items as machine parts, steel rails, grinding balls and liners, and miscellaneous supplies, must still be purchased outside the country. Apparently, no company has yet undertaken its manufacture, despite the advantage of the tariff and the existing exchange, save one that is located in San Luis Potosi, where it is manufacturing centrifugal pumps.

During the year, recommendation was made by the Secretariat of Communications and Public Works that freight rates be increased. The matter is still pending. The move is being strongly opposed by those who feel that, if successful, it will deal a heavy blow to the export of minerals, especially of unrefined products, concentrates, and raw ores.

Certain matters there are of which much is heard but which when investigated seem to have made but little progress. One of these is the growth of the miners' cooperative society. Such societies, formed by workmen for the purpose of taking over idle or abandoned properties for operation on a cooperative basis, appear to be spreading with Government encouragement. No important properties, however, have been taken over by force. Some, with ore of marginal grade, which could not pay the wages demands by the unions, are reported to have been turned over by their owners to the workmen. But the movement has been relatively unimportant.

Federal Mineral Reserves are likewise heard of frequently. Presidential announcements have been made from time to time regarding the addition of various areas to the Reserves, as for instance when some eight states were declared reserves for coal and iron, or when a narrow strip bordering the entire coast was specified as a salt reserve for Federal use. Thus far the reserves seem of little importance save on paper. In fact, the allegation is made that they are not reserves at all.

[2] In the table referred to in the February, 1936, issue the tax on silver was through a typographical error stated as centavos per kilogram instead of pesos per kilogram.

Engineering and Mining Journal
February, 1937

Recalling Some EVENTS *of* 1936

1 IVAN IVANOVITCH has been taught by the "Stakhanov movement," to step on it and turn out more gold and silver, copper, lead, and zinc, as well as everything else in general that will help in the defense of the Soviet Union. Increased production has resulted

2 LABOR DISTURBANCES also recorded themselves on the mining history of 1936, in instances where workmen became dissatisfied. Here is a small crowd of striking miners at Park City, a lead-silver camp in the Wasatch Mountains in Utah. This strike was settled in December

3 ANOTHER NICKEL MINE entered production in 1936. Here is the plant of B. C. Nickel Mines, near Choate, in British Columbia. Over 100,000 ft. of diamond drilling has been done and a 500-ton mill is planned. Japanese buyers are said to be interested in purchasing the ore. Tunnel portal, assay office, and shops are in the upper right; bunkhouses, compressor plant, and office in the center

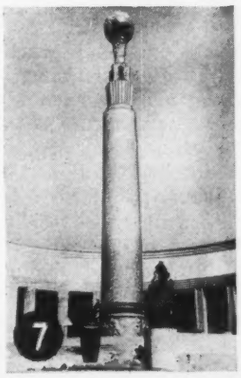
4 GREAT BOULDER, important gold producer of the East Coolgardie district, in Western Australia, and typical of many others, decided to increase its milling rate in the plant here seen, which was started in 1934. The new work began last summer. The district, which includes Kalgoorlie, leads in output of the precious metal in Australia

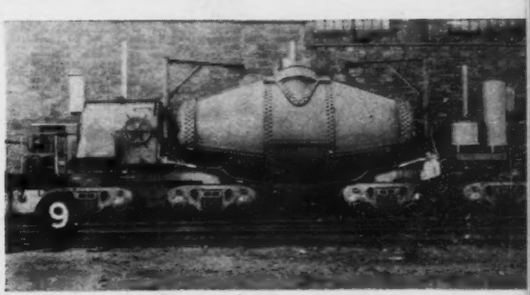
5 POWER from Boulder Dam, on the Colorado River, in Southwestern United States, will, it is hoped, find part of its market in manufacturing industries to be established in the vicinity and utilizing near-by mineral raw materials. Non-ferrous metal deposits in the tributary area are, for all practical purposes, those of gold, silver, copper, lead, and zinc. The Dam was put in service in 1936

6 DISASTER, in places, marred the picture of widespread prosperity that might be painted for 1936. Here is a glimpse of the havoc wrought when a dam broke above the Osaruzawa copper mine of the Mitsubishi company, in Akita prefecture, Japan, on Nov. 18. Several hundred persons perished. A month later another dam failed in the same locality, with further casualties. The dams were part of the company's power system

7 THE RAND'S golden jubilee was duly celebrated when in September the Johannesburg Empire Exhibition was opened. This "Golden Pillar" represented three years' gold output from the mines

8 A FRATERNAL VISIT by the American Institute of Mining and Metallurgical Engineers to their brethren of the mining industry in Mexico signalized the month of November. On the occasion here depicted the visitors are seen lunching in the grottoes (Las Grutas) at Teotihuacan, as guests of the Governor of the Federal District





9 INTERNATIONAL NICKEL showed its progressive spirit when, last year, among other achievements, it placed in operation this insulated "hot-metal" car for transporting its blister copper directly in the molten condition from the converters to the refinery, a mile away.

AFRICA

Mining Expands—The Gold Industry Presents Stirring Picture

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A GUESS that nearly half of the world's prospecting, mineral exploration and mining development and equipment activities are now confined to the continent of Africa would not be far wrong. The rise in the price of gold did not put any more of the metal in the ground but it so greatly increased the value of what was already there as to prompt a reexamination of all known regions in which gold had been found. It also won a ready hearing for prospectors from those commanding the technical talent and financial resources to develop mines. This new interest, awakened four years ago, has continued to grow, and the past year was one of great and expanding activities in scores of directions.

Increasing demand and higher prices for other metals and minerals produced in Africa gave further stimulus to activities before the year ended. Prospecting became a more attractive pursuit, as the search need no longer be for gold alone. Producers of copper, tin, lead, zinc, chrome, vanadium, and diamonds, as well as of gold, increased their outputs and again turned their attention to the possibilities of future expansion of productive capacity. Confidence was so greatly strengthened that almost unlimited funds became available for mining development and equipment.

No outstanding mineral discoveries were reported from North Africa, the chief mining activity in that region being the production of phosphate rock. Some of the small lead and manganese mines resumed production. Prospecting for gold in the Sudan (believed by some to be one of the sources of Ancient Egypt's large supply of gold) seems so far to have revealed little or nothing of value. But it seems that an intensive search for minerals in Abyssinia is already beginning, and if half the wealth is found that is believed to exist it will give the northern part of Africa a wonderful mining future.

The feverish search for gold in Kenya Colony seems to have abated somewhat during the past year, it evidently having become apparent that no big mines are likely to be developed there. Two or three of the properties are promising.

In Tanganyika Territory at least

two important gold mines are apparently under development. Just south of Lake Victoria extensive development and drilling have been proving wide and continuous veins which carry approximately 6 dwt. of gold per ton. A sufficient tonnage has been put in sight to justify a plant, and funds for that purpose have been provided. Construction of a mill was started during the year. Deeper and more extended development in the Lupa gold field greatly improved the prospects of East African Goldfields. The Territory is being intensively prospected.

Union Minière du Haut-Katanga, the big Belgian Congo copper producer, was gradually released from output restriction as the year advanced. Development work had been continued and proved ore reserves increased. While operating at far less than capacity, the company demonstrated its ability to earn substantial profits with copper at very low prices. Its plans for continuing expansion seem in no way to have been modified. It is about to erect a second roasting plant to deal with its increasing output of sulphide ore. The work of drilling, by an associated company, the strip of property along the south boundary of Union Minière's holdings, appears to have diminished, but only after considerable tonnages of ore of the Northern Rhodesia type had been proved.

The vast alluvial tin area which has been under development in the Belgian Congo during the past few years, and which is already producing over 6,000 tons of tin annually, was extended further during 1936. Plans are being made and equipment is being provided for increasing production as rapidly as circumstances permit.

Kilo-Moto mines, in the Belgian Congo, are continuing to increase their gold output. Their production for the past fiscal year was "slightly over seven tons of gold" (186,865 oz.). It is understood that the end of output expansion is not yet in sight.

Copper production was being increased in Northern Rhodesia when 1936 ended, in keeping with the relaxation of the output curtailment agreement. Roan Antelope completed the new Storke shaft to the 820 level and began sinking below that point. It continued extending its drives to the northwest on both sides of its synclinal orebody, this work confirming its diamond-drill records and opening out the mine for a larger future production. Of the several plans adopted to reduce production costs, the most important was the installation of finer grinding equipment which delivers finer material to the ball mills, this increasing the capacity of the mills and effecting a saving of power.

Rhokana Corporation similarly continued to extend its mining developments and to improve its operating methods throughout 1936. The cobalt content of its ore, readily recovered in smelting, has proved an important asset, as there is a ready sale for cobalt at about 7s. per pound, due to its greatly increased use in making magnets for loud-speakers and other purposes.

Mufulira Copper Mines further increased its production and profits in 1936, and greatly extended its underground developments. Study of production costs is giving gratifying results.

By turning its Nchanga properties over to a subsidiary company, Rhokana has opened the way for the creation of a fourth important copper producer in Northern Rhodesia. A large expenditure will be entailed, and probably four years will be required to bring the property to production.

Having proved the existence of what

appear to be large bodies of lead-zinc ore by drilling at depth, Rhodesia Broken Hill Development Company decided to supplement its zinc plant with a flotation mill for the recovery of lead concentrates.

Gold-mining development continued rather disappointing in Northern Rhodesia, except that sufficiently favorable conditions were found by Rhodesian Minerals Concessions in its Chakwenga prospect to prompt the installation of equipment for deeper and more extended operations.

Stimulated by the higher price of gold, the many small low-grade mines in Southern Rhodesia continued to expand their activities, and a further gain in the Colony's total production was recorded. A number of old properties were taken up for exploration. It is understood that a very large shear zone is being opened and tested extensively by one of the big mining finance companies. Another interesting development reported is that in two examinations the gold-bearing quartz has been found to be replaced by lead ore at depth. It is understood that the feasibility of working these lead deposits is being considered.

The Witwatersrand gold district, in the Union of South Africa, is probably the scene of greater mining activity than any other area in the world. As compared with 1932, the district is employing 99,788, or over 40 per cent, more men and crushing 34 per cent more ore. A large proportion of the additional men are working for the great number of new companies, of which 15 are already engaged in sinking 23 new vertical shafts. It is claimed that except for the higher price of gold the district would now be crushing 20 per cent less ore than it was in 1932, and that there would be practically no capital expenditure, as the average recovery of gold has fallen since then by 1½ dwt. per ton. This decrease in yield is due to treatment of more low-grade ore, ore which has been made commercial by the rise in the gold price, and not by diminishing values at depth. The older mines generally are giving attention to low-grade ores left unbroken, extending milling facilities and sinking 13 additional shafts to make this and other ore available, in keeping with plans for expansion of production. By drilling and other geological investigation the known gold-bearing area of the Witwatersrand has been greatly extended, and the belief is held that a still further length of some 50 miles will be added during the coming year or two. With gold at 142s. per ounce, the working profits of the producing mines of the Witwatersrand area are $13,000,000 a month.

Diamond mining, hit almost the hardest of all industries by the depression, underwent a most remarkable recovery during the past year and is now definitely prosperous. This is, of course, overwhelmingly an African industry. The proportion produced from alluvial workings seems to be gaining steadily on those coming from the underground mines, the output from Southwest Africa, the Gold Coast, and Sierra Leone having increased greatly. It is apparent, too, that much better stones are coming from alluvial workings. For instance, the average price of the mine stones sold last year is reported to have been 18s. 3d., and of alluvial stones, 62s. 9d. per carat.

The astonishing revival of interest in gold mining in the Gold Coast area, which began three years ago, continued to increase during 1936. Several of the big mining finance companies provided additional funds and sent their technical men to direct and supervise exploration and development. The results of their heavy expenditures seem clearly to be proving them to have been justified, as the gold production of the area is increasing, the companies which began producing last year and the year before are doing well, and several of the properties being explored and developed are giving distinct promise. In December, Gold Coast Selection Trust formed and financed Bremang Gold Dredging Company. This is a £1,000,000 corporation. Its object is to equip and work areas along and adjoining the Ankobra River, in which 93,900,000 cu. yd. of alluvial has been proved to average approximately a shilling of gold per yard, and the greater part of which remains to be drilled. At the outset £485,000 of working capital is being provided.

Africa's production of coal, diamonds, chrome, asbestos, platinum, and of numerous other mineral products also increased in 1936. The freight and passenger traffic of her railways was far greater. Indeed, Africa seems to be foremost among the beneficiaries of the world-wide devaluation of currencies. It is computed, for instance, that the value of Africa's gold output last year was £72,532,830, and that if gold had remained at the old price its value would have been only £45,765,005. This is indicative of the prevailing confidence and scale of activities in the Gold Coast area.

AUSTRALIA

Gold Output Increasing—Many Mines Approaching Production

Peter G. Tait
Melbourne, Australia

COMPLETE FIGURES of the gold output of the Commonwealth of Australia for 1936 are not yet available, but it is safe to assert that the total will be considerably over that of 914,000 fine ounces produced in 1935. For the first nine months of 1936 production was 837,380 oz. fine, as compared with 634,291 oz. in 1935. Of this, Western Australia produced 608,000 oz., but all the states record improvement. The year's output of the six will exceed 1,000,000 oz. Australia's record year was 1903, when the Kalgoorlie mines were at their zenith, the production for that year being 3,800,000 oz. fine.

The bonus on gold, granted by the Australian Government prior to the rise in the metal's price, gave the necessary stimulus. With the world price of gold plus the 25 per cent exchange, the Australian currency value of the metal makes the local price more than double the former standard value.

Western Australia—The Kalgoorlie field, with the Lake View & Star, Great Boulder, Boulder Perseverance, North and South Kalgurli as the main producers, has many years of life under present conditions. The companies have taken into their reserves large tonnages of ore which was not commercial when gold was at the standard

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price. Golden Horseshoe (New) is still engaged on treating the old dumps, and has recently acquired several dumps on the Great Boulder. The Paringa is to install a mining and ore-treatment plant. Everything looking like a mine is being worked.

The Wiluna field is very promising. Wiluna mine is treating about 50,000 tons monthly, and has reserves of about 2,000,000 tons valued at 26s. 3d. at the old standard price. An extensive lode system has been proved on the company's large area to a depth of 1,400 ft. The Moonlight mine has promising prospects. Its ore is treated in a separate flotation section of the Wiluna mill, which also supplies the companies with compressed air, electric power and water. The antimonial flotation concentrate from both mines is now smelted in a blast furnace with flotation concentrates from the Northampton mines, the bullion being refined for the recovery of the gold, silver and byproducts, and the antimony as dross.

The Lancefield, at Laverton, is raising more than 10,000 tons monthly, averaging 7.81 dwt. Diamond drilling has proved the orebody below the 1,450-ft. level. The Yellowdine Development Company, in the Yilgarn field, began treating its ore in May, and is handling about 5,000 tons monthly. The Triton, 35 miles from Cue, in the Murchison gold field, is treating about 7,000 tons of 7-dwt. ore monthly. Ore reserves are estimated at 157,000 tons averaging 8.3 dwt. The company is paying dividends.

The Norseman field is in a more favorable position. Norseman Gold Mines has increased its milling capacity to 7,000 tons monthly, and has ample reserves. It is paying dividends.

Recently discovered, the Comet mine, at Marble Bar, in the far northwest, which was worked by prospectors, has been taken over by London interests associated with Kalgoorlie. Another promising new venture is the Big Bell mine, 18 miles from Cue, in which the American Smelting & Refining and the Premier Gold Mining companies hold large interests. It is a low-grade property, estimated to contain 2,500,000 tons of ore, from which an average recovery of 3 dwt. is anticipated.

Claims by the labor unions for a reduction in hours are expected to come before the State Arbitration Court soon. At present operations are on a 44-hour week basis for both surface and underground employees. The ruling minimum rate paid to employees of the Kalgoorlie gold mines is 99s. per week. All underground employees receive an extra 3s. per week, and then there is a long schedule of marginal rates for skill. And employees in some other fields receive additional allowances.

New South Wales—Despite its great history, the Broken Hill field has still many years of life. A new company, New Broken Hill Consolidated, has been formed to develop the adjoining leases south of the Zinc Corporation property. North Broken Hill has announced erection of a 12,000-tons-per-week gravity-and-flotation mill.

The Broken Hill mines have benefited greatly by the rise in metal prices. Approximately 4,400 men are employed along the line of lode, or 1,000 more than a year ago. Both surface and underground employees enjoy liberal conditions. The minimum wage is 80s. per week (now increased by 20s. per week by the operation of the bonus varying with the price of lead). An annual holiday based on attendance (one day for each 25 shifts worked) and extra pay for night shifts are also allowed. At the Broken Hill Associated Smelters, at Port Pirie, the employees have been granted similar concessions. This has increased costs, and a higher charge for smelting has been passed on to the Broken Hill mines.

New Occidental has acquired the New Cobar mine, in the Cobar district.

Both mines are old producers, long idle. Ore reserves of the former are estimated at over 300,000 tons to the 840-ft. level, assaying 8 dwt.; and in the New Cobar reserves to 525 ft. are 140,000 tons, of which 102,000 tons contain 7.3 dwt. gold and 1.75 per cent copper. In both properties there is much "probable" ore. The New Occidental treatment plant has a capacity of 7,000 tons monthly. A flotation plant with a capacity of 4,000 tons monthly is being installed at the New Cobar.

Another important gold producer expected to start in 1937 is Wellington Alluvials, an offshoot of the Broken Hill Proprietary, Ltd. A dredge is being built to treat ground on the Macquarie River. Over 60,000,000 cu. yd. of payable wash has been proved.

Sulphide Gold Junction Reefs, at Mandurama, having proved 233,400 tons of ore, has decided to install a new 100-ton mill.

Victoria—Bendigo Mines, Ltd., with its three main subsidiaries, has spent much money in an effort to resuscitate the field. Though no sensational discoveries have resulted, a 30-stamp pilot mill was being installed, to start before the end of 1936.

Cock's Eldorado dredge, in the Wangaratta district, of a capacity of over 175,000 cu.yd. monthly, is now dredging. About 18,000,000 cu.yd. is available of a value (gold and tin) exceeding 8d. Estimated working cost is not more than 3d. per yard.

Rutherglen Gold Dumps, a subsidiary of Placer Development, Ltd., has started a large plant at Rutherglen for re-treating dumps containing over 2,000,000 tons assaying 0.045 oz. gold per short ton. This is being done profitably at the rate of 18,000 tons monthly. A similar plant is being erected in the Carisbrook district. The slum is sluiced by monitors using cyanide solution, and the pulp pumped to the treatment plant.

Numerous small companies are at work in Bendigo and other districts of Victoria. The Chewton field, near Castlemaine, is attracting attention.

The two leading gold producers in Victoria are the Morning Star, at Gaffneys Creek, and Gordon's Gold, in the Ballarat district. Both are treating 5,000 tons per annum, yielding nearly 2 oz. per ton.

Queensland—The reopening of the famous Mount Morgan mine several years ago is one of the brightest spots in the revival of gold mining in Australia. It was, however, the increase in the price of gold which saved the situation. The plant has been remodeled and is treating at the rate of 300,000 tons per annum. Sulphide ore reserves amount to 7,500,000 tons assaying 4.26 dwt. gold and 1.77 per cent copper.

Since the mill was started on the Golden Plateau, in the Cracow field, the company has paid £483,000 in dividends. About 50,000 tons is treated annually, the mine costs for the past year being 21s. 8d. per ton.

The outlook for Mount Isa Mines has improved with the higher price of lead coupled with improvements in treatment. During the year the zinc mill started production, and zinc concentrates are being exported regularly.

Tasmania—Mount Lyell is reaping the reward of its efforts to reduce costs. For the year ended with September last, the mill treated 665,400 tons of ore. The net cost of producing and realizing copper was £42.740 per ton, compared with £53.999 in 1934. Reserves are estimated at 8,825,000 tons of an average assay of 1.90 per cent copper, 0.14 oz. silver, and 0.016 oz. gold per ton.

Tin mines at Mount Bischoff and in

the northeast of the island are active, but, with the exception of the Aberfoyle, production is limited. Briseis Consolidated, formed to reopen the Briseis mine, at Derby, after the disastrous flood of 1929, was flooded again just when operations were approaching the production stage. Unwatering is proceeding. The Aberfoyle is paying regular dividends.

Electrolytic Zinc Company, which hitherto has drawn supplies wholly from Broken Hill, is producing about 55,000 tons of zinc concentrates and 12,000 tons of lead concentrates from its mines at Rosebery. The local production of zinc concentrates represents about 35 per cent of the tonnage treated at Risdon. In view of the growing use of aluminum, the company, which has the advantage of cheap electrical energy supplied by the government hydro-electric commission, is considering erecting works for producing this metal, and a company, British Aluminium (Aust.), Ltd., has been registered.

New Guinea and Papua—The combined output of gold from these territories now exceeds 300,000 fine ounces per year. The most important center is the Morobe gold field, where Bulolo Gold is operating. At May last, official estimates showed reserves at 204,000,000 cu.yd. of profitable ground to be dredged. New Guinea Goldfields is working both alluvial ground and reef formations. Annual production is about 50,000 oz. fine gold, but the company is hampered by a large capital.

The principal company operating in the Papuan section of New Guinea is Cuthbert's Misima, which has recently increased its plant to treat 40,000 tons per annum. Oroville Dredging Company has taken up the property formerly held by Misima Gold Reefs, and is forming a new company. Preliminary work has proved 46,800 tons averaging 5.8 dwt. gold per ton.

Fiji—The boom following the discovery of gold on the Tavua gold field has subsided, and few of the numerous companies floated are active. The Emperor and Loloma companies, on the island of Vitu Levu, show good promise of becoming large producers. The Emperor's reserves are estimated at 620,000 tons of oxidized ore averaging 10 dwt. and 50,000 tons of telluride ore. A new mill to treat 12,000 tons monthly is being erected. Loloma also will install a mill to treat 2,500 tons monthly. Reserves are estimated at 105,000 tons assaying 30 dwt. per ton. Tavua Power Pty., Ltd., is installing a 2,000-hp. diesel generating plant to supply both companies.

Another company now past the prospecting stage is Mount Kasi, on Vanua Levu. A fair tonnage of 8-dwt. ore has been proved, and a small treatment plant installed.

SOVIET UNION

Industry and Defense Demand More Copper, Lead, and Zinc

H. C. Chellson
Assistant Editor

THE non-ferrous metal industry in the Soviet Union mined and smelted more ore in 1936, the fourth year of the Government's second five-year plan, but results did not fulfill objectives set for the year. Therefore, this industry continues deficient, due to lack of experienced engineers, insufficient machinery, and inability fully to utilize existing equipment.

Menaced by threats of war, the Government has created a new Defense Commission, which consists of former members of the Heavy Industries Board. A. P. Serebrovski has achieved such a splendid record in getting results in gold mining that he has been selected as a member of the Heavy Industries Board. He will temporarily assume the important task of speeding the production of copper, lead and zinc, and the rarer metals. A. S. Shakhmourodov has been released as head of the base-metal division and G. I. Peryshkin is now in charge of the gold industry, the office formerly held by Mr. Serebrovski. Thus, reorganization and change continue as the country seeks to better itself and decrease bureaucracy, or "bullikita."

Gold—Output of gold in 1936 reached a satisfactory level, with about 7,300,000 oz. indicated. This is about 26 per cent above 1935 production. High wages, and better food supplies at the gold fields plus another year's practical experience in the use of mining and milling machinery by Russian engineers and workers, probably accounted for the increase. The ambition to become the world's leading gold producer by surpassing the Witwatersrand by the end of 1939 remains in the blueprint stage. Gold output in the Transvaal was 11,339,411 oz. in 1936. Concentrating upon manufacturing their mining equipment closer to the Far Eastern gold fields, the Gold Trust has succeeded in cutting down delays. The new strategically situated railroad leaving the trans-Siberian railway at Taishet, 400 miles west of Irkutsk, and extending northeast beyond Lake Baikal, joining the trans-Siberian at Khabarovsk, was completed in the last quarter of 1936. This line runs close to important gold-mining fields and is being utilized to transport mining equipment more effectively to these areas. Better success is reported in gold dredging during the winter months, as steam thawing of frozen ground is being more extensively used.

During the year directors of the gold industry proposed higher production rates for gold dredges and a new system of piecework for workers. In

Production, Imports, and Reserves of Copper, Lead, and Zinc in the Soviet Union

(Metal, in Short Tons)

	1934	1935	(a) 1936	Planned Production 1937 (e)	Positive and Probable Metal Reserves (d)	Total Metal Reserves All Categories (d)
Copper					9,392,900	18,807,800
Production (blister)	58,666	69,459	89,000	148,500		
Imports (c)	12,635	32,255	50,000			
	71,301	101,714	139,000			
Apparent consumption (b)	61,288	102,183	135,000			
Lead					1,287,000	4,345,000
Production	29,921	40,040	55,000	126,500		
Imports (c)	20,601	33,990	34,000			
	50,522	74,030	89,000			
Apparent consumption (b)	50,490	74,140	85,000			
Zinc					4,287,000	9,730,000
Production	29,816	50,820	63,000	99,000		
Imports (c)	4,753	1,566	100			
	34,569	52,386	63,100			
Apparent consumption (b)	34,540	52,250	60,000			

a All estimated. b American Bureau of Metal Statistics. c Statistical Survey of Foreign Trade, U.S.S.R.
d As of Jan. 1, 1936. Economic Survey Vol. 8. No. 10, U.S.S.R. Chamber of Commerce, Moscow.
e According to second Five Year Plan estimate. A more accurate figure will be announced in March.

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other words, another method based on personal initiative became effective during the last half of the year, whereby the more gold the worker produced, the more rubles he earned.

The problems involving production of gold from the youngest placer fields are little different now than some years ago. Transportation to these partly developed fields continues to be difficult. People are encouraged by higher wages to work in these new deposits where living conditions are unsatisfactory and mechanical equipment and supplies are usually lacking. The older and better established gold placer regions in Siberia, however, are enjoying somewhat better circumstances. Labor turnover has decreased, due to the provision of more and better foods, improved living conditions, and a happier social life. The better-established fields are, therefore, always under pressure to produce more gold, while more virgin fields get along the best they can, for the time being.

The gold lode mines have become better established and general living conditions have improved. These advantages, however, have not removed one important deficiency, that of poor metallurgy, which hangs on from year to year. The mills and cyanide and flotation plants that have been built throughout the country do in many cases not function properly, and recovery of metals is unsatisfactory. In many cases, tailings have a high gold content and the material must be re-treated. The research laboratories in Moscow and Irkutsk constantly receive large samples of ore to determine the best practice of extracting the various metals. A practice is prescribed and followed at the mines, but new problems arise and flowsheets are subject to many changes. This is one of the general weak spots in the non-ferrous metal industry of the U. S. S. R. Mine exploitation practice is improving slowly, but leaves much to be desired by Russian mining authorities.

Russia makes little mention of silver production, but it is considered to be ample for domestic industrial purposes and coinage.

Copper—Production of copper for the first nine months of 1936 was reported to be above that of the similar period in 1935. The average daily production of blister copper in 1935 was about 190 short tons per day. For the nine-month period of 1936 the average daily blister production was about 233 short tons. Allowing for an improved average for the last quarter, which has been fairly consistent in each succeeding year, the copper production in 1936 amounted to about 89,000 tons of blister, compared to 69,500 tons in 1935. The program for 1936 was to produce 121,000 tons of copper. If copper in ore is estimated, the figure would be higher than 89,000, as mine production increased in the last quarter. No large copper mills or smelters were scheduled for completion in 1936. In 1937 the Pyshma electrolytic copper plant is scheduled for completion and the total copper smelter capacity by the end of 1937 is planned to be 207,000 metric tons.

The principal copper deposits so far developed lie in the vast steppe country of the Autonomous Republic of Kazakstan. The most important copper mines here are those at Kounrad and Djezkazgan. Of these the former is a porphyry copper deposit which entered production during the last quarter of 1936. In the third five-year plan, beginning 1938, a copper smelter having a capacity of 200,000 metric tons annually will be constructed near Djezkazgan. The plant will be built near the Kara Kenshir River. Proper utilization of this site is planned to support a large community, as the country is very similar to our Southwest.

Soviet workers are happy to see their copper production increase each year, but it must not be overlooked that copper imports have also risen. To meet the increasing industrial demand and extra tonnages for defense purposes, production must be speeded and Stakhanov drives multiplied. In many mines production was increased under an intensive Stakhanov movement. At mills and smelters special tests were made and it was found that efficiency could be improved. The objective is to maintain these improvements, but in many instances this has been difficult. The Russians strive to produce the same tonnage of copper per square meter of hearth area as in American and Canadian smelters, but even under the Stakhanov drives this was not achieved. The net improvement so far in the second five-year plan is, however, greater than in the first five-year program. Until larger smelting facilities are provided and efficiency has been improved in the existing mines, mills, and smelters, it is not likely that the planned production of 148,500 short tons of blister will be fulfilled in 1937.

Lead—Production of lead in 1936 is estimated to be about 55,000 short tons. This amount is not much more than one month's apparent consumption of lead in the United States. In 1935 the production was 40,040 short tons; therefore, the Russian showed some improvement here during the year.

Progress at the Chimkent lead smelter, in Kazakstan, and higher production from lead mines in the Kara-tau range 145 miles away, helped account for some of this increase. Improved mechanization at the Ridder group of mines, in the Altai region in southeast Kazakstan along the Chinese border, also accounted for higher production. The last section of the new 1,000-ton mill at Ridder started operating in 1936. Metallurgical practice here deals with complex ores, and difficulties are numerous, but some improvement in metal recovery is reported.

Other lead deposits being exploited are in the Tetiuhe district north of Vladivostock, the Sadon mines in the Northern Caucasus, and mines in the Salair, Nerchinsk, and trans-Baikal regions in the Far East.

Zinc—Production of zinc has consistently improved from year to year and there is a possibility that this metal will come closer to fulfilling its objective at the end of the second five-year plan than copper or lead. During 1936 it is estimated that 63,000 short tons was produced, compared to 50,820 in 1935. The zinc is mined principally from zinc-lead deposits where the metal content is usually higher in zinc than in lead. The large Ridder mines have a zinc content in the sulphide ore almost twice that of lead.

Three large smelters have been in operation since 1934. They are the Orjonikidze electrolyte zinc plant, in

North Caucausus; the Konstantinovka zinc distillation plant, in the Ukraine, and Belovsk zinc plant, in Western Siberia. At the end of 1937 two new zinc plants are scheduled for completion. The largest of all installations will be the Kemerovo electrolytic plant, in the Kuznetz Basin, and the Cheliabinsk electrolytic unit, in the southern Urals.

Nickel—Deposits of nickel in the Soviet Union are very scattered, and only one district is producing the metal. This is the Ufalei nickel mine and smelter, in the Ural, which is now producing about 10 tons of nickel per day. The Ufalei deposit is not very large; therefore, effort is directed to determine if the Aktiubinsk deposit, located in the southern Urals not far from the Orenburg-Taskent railway, has any merit. Near the mouth of the Yenisei River, above the Arctic Circle, prospecting continues on the Norlinsk deposit. In the Kola Peninsula, also north of the Arctic Circle not far from Murmansk, is a low-grade complex deposit under development. Nickel reserves are very low and Russia is importing metal in increasing quantities. During 1936 it is estimated that about 8,500 tons of nickel were imported, compared to 6,140 tons in 1935.

Tin—Practically all of the tin consumed in the U.S.S.R. is imported. Prospecting and development continued in the three most promising regions, the trans-Baikal, Kazakstan, and the Far East. Examination of areas in Eastern Kazakstan during 1936 is reported to have found greater possibilities of tin. Imports in 1936 are estimated to be close to 11,000 tons, compared to 8,175 tons in 1935.

At the annual meeting of directors and managers of Soviet mining enterprises held recently in Moscow, Mr. Serebrovski said that base-metal production must be increased. He said more effort must be devoted to producing the rarer metals, and the conference pledged the following in 1937: increase aluminum output, 50 per cent; tin, 100 per cent; nickel, 90 per cent; molybdenum, almost threefold; tungsten, 80 per cent; and mercury, 25 per cent.

The non-ferrous metal industry is now entering the last year of the second five-year plan, and much remains to be done to fulfill all the programs. The fear of aggression on the East and West naturally presses demand for metals vital for defense. Aluminum production is making rapid strides and the metal is used wherever possible so that copper can be used in brass making and other important lines of consumption. During 1937 there will probably be a marked improvement in production of metals, as there was in 1936, but it is considered doubtful if all metal production quotas will be filled as planned.

JAPAN

Mines Spurred by Armament Plans And Favorable Exchange

Burton Crane
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TWO FORCES have been responsible for the steady advance of Japan's mining industry in the past several years. The first has been the success of the Finance Ministry in maintaining a high internal value for the yen ever since the collapse of its external value in 1931-32. The second has been heavy Government spending for armaments, which has given an artificial stimulus to metal-using industries.

A yen which will still buy 83 per cent as much as in 1931 and 110 per cent as much as in 1929 has been the main factor for expansion in gold mining, for wages remain the same. Mines in Japan and Korea are mostly low-grade producers which barely paid operating expenses in the days before the yen's decline. Today they are prospering handsomely. It is noteworthy that, because the ores are of low grade and therefore require heavy initial investments to handle a profitable volume, most of the gains have been due to expansions of old plants rather than formation of new companies.

Gold production in Japan, Korea (or Chosen), and Formosa has been rising spectacularly and in 1936 amounted to an estimated 38,590 kg., gaining 141 per cent over 1929. This figure is based on a 17 per cent gain over 1935 for Japan proper during the first eight months of 1936. In Korea the Government-General is operating a plan for the encouragement of gold production and now has five mines producing more than 1,000,000 yen annually, as well as twenty smaller mines with outputs ranging from 200,000 to 500,000 yen. Formosa's gains were especially marked in 1936.

Japan's principal gold-mining companies today are Teikoku Sankin, Chosen Dredge, Seikan Kogyo, Zenra Kogyo, Japan Kogyo, Toho Sankin, and Nippon Seiko, all either newly organized since 1931 or on the verge of bankruptcy when the yen was unpegged from gold.

Teikoku Sankin (Imperial Gold Mining) started operations in January, 1934, at Oito, in Idzu, south of Tokyo. This concern, with an original paid capital of 2,500,000 yen, doubled it at a directors' meeting held Oct. 29 of last year. It earned 242,00 yen for the first half of 1936 and estimated profits of 300,000 yen for the latter half.

Since April of 1934 the Bank of Japan has been building up its sorely depleted gold reserves by buying from domestic producers, taking roughly 70 per cent of the output. Until late in the spring of last year its official purchase price was steadily 26 per cent below the world level, and the mining companies would not have sold to it were other outlets available. In May, however, the Government took a more realistic view of the situation and altered the price, partly due to a desire to encourage domestic output and partly to check the smuggling across the North Korean frontier into Manchukuo, which was known to be buying gold at a price that was nearer the world level.

From a broad view, the most important mining event of 1936 for Japan was the birth of the Japan Nickel Company, the first of its kind in Japan. The new concern was given an initial capitalization of 5,000,000 yen (about $1,500,000) and expects to use *jamoniwa* ore, found in Gumma Prefecture to an estimated total of 30,000,000 metric tons. Original plans called for use of ores from New Caledonia, but apparently these have been abandoned due to the desire of the military to have a domestic supply. The first stage of construction envisages a plant with a daily capacity of one ton a day, to be completed by the end of April.

K. Miyazaki, who is in charge of the technical features of the new company's work, is head of the refining section of the Japan-Manchukuo Aluminum Company and is noted for his success in manufacturing low-carbon ferrochrome at the plant of the Chichibu Electric Industry Company. In

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the name of the new concern he has applied for seven patents covering nickel-refining processes which he has developed.

Great emphasis is being placed upon self-sufficieney in the materials needed for armaments. This emphasis explains Japan's present petroleum policy, its great gains in aluminum manufacture, and its efforts to develop its own low-grade iron ore deposits, rather than import much cheaper pig iron from abroad. Thus one may take for granted that the army is behind the new concern. Imports of nickel for the past three years are given in a table.

Japan, it will be recalled, went off gold in December of 1931, partly because of British example, partly because of nervousness over the outcome of the Manchurian adventure. In 1932 the situation on the continent of Asia was enlarged and the budget commenced to grow. The army and navy discovered an urgent need for "replenishment" of material, and commenced to talk about the impending crisis in international relationships. Accordingly, Japan lost its status as an exporter of copper on balance and began to import. This movement has continued steadily ever since, despite a reversal of the downward trend in domestic copper output. This reversal came slowly, for Japan's copper mines and refineries were sorely out of date when the need for expansion of output became apparent. Mining engineers who visited the leading plants of the country some years ago, when the World Engineering Congress met in Tokyo, returned to that city with tears in their eyes. Never, they claimed, had they seen a worse waste of bountiful natural opportunities. Even today little has been done to improve the properties. Production has been expanded by brute force.

The Sumitomo Goshi Kaisha has been an exception. Its Besshi mine and smelter, on Shisaka Island, have been thoroughly modernized and stand in the forefront of metallurgical improvement. The same company has also brought up to date its gold operations at Konomai and Ogayu. At Yoichi it is working gold, silver, lead, and zinc ores which carry about 1 per cent copper.

The biggest gold producer in Japan is the Nippon Mining Company, a subsidiary of the Nippon Industrial Company. It handles copper, gold, silver, iron, and coal, but its methods are far from modern according to world standards, its equipment being merely an extension of old installations, with minor Japanese improvements. The same applies to Furukawa & Company, which has mines at Ashio, Mizusawa, Nagamatsu, Iimori, and Kune (among others), with a copper smelter, a refinery, and wire-drawing works at Nikko. The Ashio mill, largest in the country, uses flotation after sorting high-grade copper ore for direct smelting. There has been no serious modernization in recent years.

In products such as silver, copper, lead, and tin, in which Japan could easily become self-sufficient in the event of hostilities, there is no open Government encouragement. Even zinc is not down on the list of metals to receive special aid. But iron, aluminum, and nickel are looked upon by the military as prime requisites and are being pushed.

Aluminum already has made marked progress. True, imports continue to rise rapidly, due to expanding demand, but domestic production is going forward with increasing acceleration.

The army is not yet satisfied with the quality of the aluminum turned out of Japanese refineries and refuses to allow its use in many important implements, but it is finding its way into manufacture of kitchen utensils and the surfacing of high-tension electric cables.

Today the biggest producer in Japan is the Japan Electric Industry Company. Unfortunately, most of the criticism of quality is centered in its products. The Nichiman (Japan-Manchurian) Aluminum Company is the second company in the field and is now dominated by the Mitsui interests. There are rumors in Japan, however, that the Sumitomo company has been buying up its shares. Sumitomo, it is said, wishes to obtain control of the Nichiman manufacturing method so that it may be used by the Sumitomo Aluminum Manufacturing Company. It now uses the Japan Electric Industry process under license.

Imports of Nickel into Japan

	In Metric Tons
1933	3,257.76
1934	2,638.44
1935	3,417.42
1935 (first 10 months)	2,693.04
1936 (first 10 months)	1,962.36

Gold Production in Korea and Formosa, 1929-36 Inclusive, Kilograms

Japan Bureau of Mines

Year	Korea (a)	Formosa
1929	5,553	453.0
1930	6,186	478.0
1931	7,243	542.0
1932	9,701	778.5
1933	11,508	599.0
1934	12,428	1,002.9
1935	14,710	1,157.6
1936	(b)16,500	(b)1,220.0

(a) Including alluvial gold (b) Including estimates

Gold Production of Principal Gold Mines in Japan Proper, Kilograms

Mines	1934	1935	(a)1936
Hidachi	2,985	3,549	2,551
Sagaseki	2,732	3,184	2,726
Taiu	2,000	2,050	1,061
Naojima	1,013	1,551	1,138
Konomai	1,493	1,500	1,325
Kozaka	924	924	759
Mitsuigushi (b)	1,015	919	673
Besshi	758	805	496
Osaruzawa	201	349	357
Mochikoshi	128	363	368
Sado	252	294	167

(a) Production during eight months, January to August (b) Including production at Kino

Gold Bullion Quotations In Japan

Year	(a) Government Purchase Price (Japan)	(a) Tokyo Market	(b) London Market
1931	....	1.366	4.63
1932	2.133	2.107	5.92
1933	2.451	2.687	6.24
1934	2.871	3.279	6.88
1935	3.087	3.159	7.10
1936			
January	3.090	3.180	7.05
June	3.500	3.547	6.93
Sept.	3.500	3.578	6.90

(a) Price in yens per gram. (b) Price in pounds per ounce.

Production of Principal Metals in Japan, 1926 to 1935, Inclusive

Year	Gold, Kg.	Silver, Kg.	Copper, Metric Tons	Lead, Metric Tons	Zinc, Metric Tons	Tin, Metric Tons
1926	9,063.3	136,864.3	62,562.7	.....	.....	.....
1927	9,313.5	134,784.4	60,545.3	.....	.....	.....
1928	9,657.7	149,350.6	61,791.5	.....	.....	.....
1929	9,908.6	155,589.0	75,783.5	.....	.....	.....
1930	11,331.4	159,483.2	77,911.5	.....	.....	.....
1931	12,200.3	167,315.3	74,814.0	.....	.....	.....
1932	12,334.3	163,035.3	71,012.5	.....	.....	.....
1933	13,492.7	185,345.1	69,313.7	6,808.6	28,900.9	931.1
1934	14,661.6	214,059.4	67,777.8	6,777.7	29,637.3	1,181.3
1935	17,837.4	253,608.3	69,829.8	7,195.3	31,300.9	2,059.6

THE PHILIPPINES

As Elsewhere, Gold Mining Thrives Base Metals Win Attention

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WELL-ROUNDED development marked Philippine mining during 1936, and the end of the year found prospects for the future the brightest that the industry has known. Most important has been the increase in gold production. The total for 1936 will be nearly 44,000,000 pesos; the 1935 output was 32,911,353 pesos. At the close of 1935 there were thirteen gold-producing plants; there are now nineteen. The monthly tonnage treated in mills serving lode mines was approximately 132,000 by December, 1935; that for November, 1936, was nearly 215,000 tons.

Dividends declared in 1936 amounted to 19,628,333 pesos, from sixteen companies; the total paid during 1935 was 12,528,589 pesos. During November and December six new companies declared their first dividends.

Further expansion now under way will boost the gold output considerably in 1937. Benguet Consolidated, San Mauricio, United Paracale, and Big Wedge are increasing their milling capacity.

The Islands have had a mining boom which has resulted in the organization of some 200 new mining and mine management companies. Of these, only a few have any chance of success. The newly created Securities and Exchange Commission is doing much to discourage wildcat promotions. Some of the new companies, however, have bright prospects. A number of properties in the Paracale-Mambulao district have been thoroughly developed, and plans for mills are being discussed. In the Mindanao district one plant has been ordered, for the Mindanao Mother Lode Mining Company, and several more will be built during 1937.

A most important achievement for 1936 was the starting of a base-metal industry. A year ago, the Philippine Iron Mines, at Calambayungan Island, near Paracale, was the only exporter of a metal other than gold and silver. Now chromite is being shipped from the Florannie property, in Camarines Sur, which has 100,000 tons of high-grade ore blocked out by Benguet Consolidated, and orders have been placed with the same company for ore from the large deposit at Masinloc, in Zambales. Copper and manganese ore are being shipped, in small quantities, from the Ilocos properties, at the northern end of Luzon. Amalgamated Minerals, a company organized to deal in base metals, has contracts for copper, manganese, and other metallic ores with Japanese and European consumers.

The three leading mining organizations maintained their positions and prospered during 1936. The Benguet interests, in addition to increasing production at Benguet Consolidated, Balatoc, and Ipo, started the Cal Horr plant, and brought the Florannie chromite mines into production. Benguet has also developed the Masinloc chromite deposits of Consolidated Mines to the point where mining can soon be started.

Marsman & Company's four lode gold producers—Itogon, Suyoc Consolidated, United Paracale, and San Mauricio—have steadily increased their output, and its gold-dredging project at Coco Grove has been brought into production. A 9,000-ft. drain tunnel, longest in the Philippines, has been started under the Suyoc district. When completed, it will open up many properties hitherto unexplored. A 50-ton smelter, the first to be built in the Philippines, has been ordered for installation near Mambulao. It will treat flotation concentrates from San Mauricio and United Paracale, and copper ore from other properties.

Marsman Hongkong China, Ltd., has been formed as an operating organization for China. An option on diamond-platinum-gold properties in Dutch Borneo has recently been signed.

The four plants of the Soriano group—Antamok Goldfields, Masbate Consolidated, I.X.L., and I.X.L.-Argos—have grown steadily. Antamok Goldfields is now the third highest producer, turning out around 500,000 pesos a month. Masbate has the largest plant and treated 47,744 tons. I.X.L.-Argos is a new property on which a small flotation plant treats enough development ore to pay for cost of development.

Several new mine management and operating companies have been started, and each has properties under development in different parts of the Islands.

1936 Production and Dividends—Gold Producers in the Philippines

	1936 Production 1st 11 Months, Pesos	1936 Dividends Declared, Pesos	Paid-up Capital, Pesos
Antamok Goldfields	4,750,451	2,062,500	1,375,000
Baguio Gold	993,875	129,890	1,300,000
Balatoc	11,518,694	5,600,000	4,000,000
Benguet Consolidated	8,229,872	8,000,000	6,000,000
Benguet Exploration	245,750	50,000	500,000
Big Wedge	415,551	.....	777,692
Cal Horr	1,034,372	Owned outright by Benguet	
Coco Grove	337,141	.....	937,500
Demonstration	1,350,298	200,000	1,000,000
East Mindanao	164,940	.....	647,844
Gold Creek	.....	105,000	.....
Ipo Gold	555,795	116,475	776,500
Itogon	2,569,472	597,168	2,000,000
I. X. L.	1,190,148	200,000	1,000,000
I. X. L.-Argos	Not available; owned by Soriano group		
Masbate Consolidated	1,779,461	.....	5,000,000
Salacot	394,256	.....	2,400,000
San Mauricio	1,464,341	320,000	800,000
Suyoc Consolidated	1,074,480	.....	1,250,000
United Paracale	1,304,885	275,000	1,000,000
Totals	39,373,782	17,656,033 (a)	

(a) Antamok Goldfields also declared 100 per cent stock dividend in November, 1936. Big Wedge started production in August, 1936. San Mauricio started production in March, 1936. Coco Grove started in August, 1936. Marsman Investments, Ltd., holding company of Marsman & Company, declared a 10 per cent dividend in December, 1936, amounting to 500,000 pesos. Marsman & Company paid 940,300 pesos. Philippine Iron Mines paid 532,000 pesos during 1936.

MINING PRACTICE

Blasting, Drilling, Stoping, Filling, Sinking, and Other Operations Afford Examples Of Ingenuity — The Rand Amazes

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THE RAND celebrated in 1936 the fiftieth anniversary of the discovery of gold in that area. One of the features was the building of an ice-hockey rink in which games were played between local teams, largely recruited from Canadian engineers now working on the Rand, and teams from Oxford and Cambridge. The quality of the hockey may not have been high, but this endeavor gives an interesting sidelight on the progressive spirit of this great mining community. This amazing district is now 150 miles long, and mining has been carried to a depth of 8,500 ft., with confident predictions that the depth will ultimately go to 10,000 ft.

Many new properties are being developed on the East Rand, and the Far West Rand gives promise of many large producers. Drilling on the Venterspost has definitely proved the existence of ore on the western segment of the reef, and two shafts are being sunk, one of which has reached pay ore. Preparations are being made for the bringing in of other adjacent properties, and there seems a strong probability that the Far West Rand will be an important part of the district. The location of the submerged outcrop of the reefs in this area is a triumph for geological study assisted by geophysical prospecting. Though much credit must go to the mining houses which risked their capital in what many considered a mad gamble, probably the greatest factor in bringing this development about was the vision, courage, geological knowledge, and technical skill of G. Carleton Jones and the engineers who assisted him. Incidentally, it may be mentioned that Mr. Jones is a Canadian who received his training as a mining engineer at McGill. The courage required may be gaged by the fact that over $5,000,000 was spent in equipping the mine and in sinking before any ore was encountered except in boreholes. No. 1 shaft reached the first gold-bearing reef at a depth of 1,682 ft. below the surface, and it will be continued to 3,100 ft. before lateral development is started. No. 2 shaft is also being sunk, and the following interesting comment was made at the last annual meeting by W. A. Mackenzie, chairman of the board:

"It may be pointed out that the depth at which the Main Reef has been intersected in No. 1 shaft—namely, just over 2,000 ft.—and the depth at which it will be intersected in No. 2 shaft—namely, 2,700 ft.—are comparatively shallow in terms of present mining depths on the Rand."

Innovations in blasting practice include a new explosive called Hydrox, which has recently been put on the market for use in gassy mines. The explosive is a mixture of ammonium chloride and sodium nitrite in the proper proportions to recombine into water nitrogen and common salt, in accordance with the formula $NaNO_2 + NH_4Cl = NaCl + 2H_2O + N_2$. Chemical change is induced by a powder fuse which is electrically ignited. The charge is confined in a steel tube with a shearing disk at one end to permit the gases to escape. Inasmuch as all the resultant products are inert, the cartridge can be safely fired in an explosive atmosphere; in fact the products of explosion are all preventers of flame. They are also non-toxic. Hydrox has the advantage of using solid chemical salts, so that no expensive charging apparatus is necessary.[1]

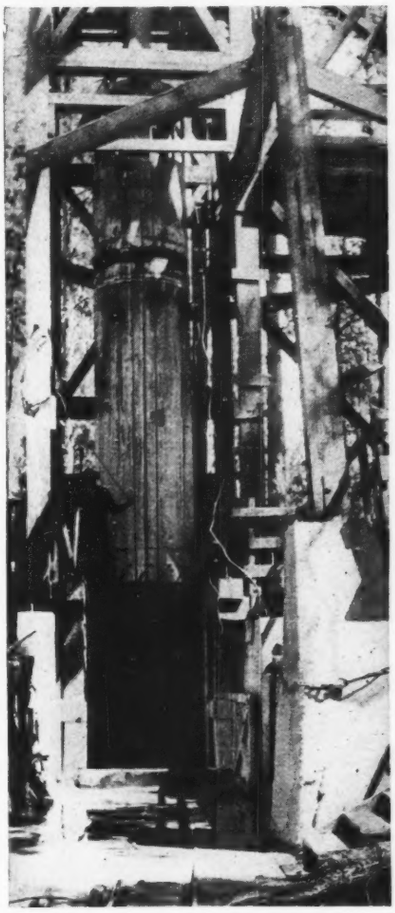
Anaconda has introduced into its Butte mines a method of "bunch" ignition of fuses, which was developed to permit the use of electric lamps but has been so successful that it has been adopted as standard for all the operations at Butte. This method gives rapid ignition of all fuses in a very short time after the ends have been cut off, and in mines where humidity is high the danger of men remaining too long to ignite difficult fuses should be practically eliminated. After the charges have been placed and the fuses cut to give the desired order of explosion they are gathered into two or four bunches and the ends of each bunch tied firmly together. The number of fuses in a bunch may vary from four to twenty, but all should be included in two or more pairs of bunches with approximately the same number of fuses in each bunch of a pair. A notched "spitter" is ignited with an ordinary match and this is used to ignite one or more fuses in one bunch. The other bunch of the pair is then placed so that the ends of its fuses are opposite to and about half an inch from the pair in which one or more fuses have just been ignited. Flame from the burning fuse shoots across to ignite a fuse in the opposing bunch, which in turn shoots against another until all fuses in both bunches are ignited.[2] An ingenious cutting tool has been developed which serves the dual purpose of preparing the spitter and trimming half an inch off the end of each bunch just before the fuse is ignited.

An interesting experiment is reported from England, where Captain Hay, of the Mines Department, is attempting to neutralize the nitrous fumes from blasting with a weak solution of washing soda. Five gallons of solution is blown into the drift in the form of a mist immediately after blasting. An ingenious atomizer is attached to the end of the air hose and the air turned on as soon as the fuses are ignited. A large volume of air entering with the mist spreads it out in a cone shape to meet the outcoming gases. The flow of air continues after the solution is used up and sweeps the gases out of the drift. This device should materially assist in laying dust as well as neutralizing the nitrous fumes, but it obviously has little application except in narrow workings.[3]

An interesting step in drilling practice is the development by Noranda, primarily for use in its sublevel stopes, of the use of sectional drill steel for drilling holes up to 20 ft. in length from an opening of ordinary size. The fillers, made up in 2-, 4- and 6-ft. lengths, and the shanks are made of Atlas special, fatigue-resisting, alloy steel which is too soft for making bits. They are of 1⅛-in. round section. Up to 6-ft. depth standard drill steels are used and, for greater depth, combinations of a 6-ft. shank and varying lengths of filler and drill steel are used. The joints are made with a special sleeve coupling manufactured by the Whitehall Machine Tools Company. A left-hand, round thread is used, there being five threads to the inch.

The sectionalized steel is used for benching and pillar recovery in the inclined-raise system, for benching in the horizontal sublevel system, and for a promising modification of the latter known as the ring method. A 45-ft. bench can be broken in one operation by drilling 20-ft. holes up and down.

In the ring method the sublevel drifts are driven in pairs one on each side of a stope 60 ft. wide. From



SHAFT SINKING by boring, as performed by the Idaho-Maryland company, at Grass Valley, Calif., is one of the outstanding developments of recent years. Here are seen the drive head and core barrel

these, holes are drilled fan-wise at 6-ft. intervals along each drift, with extra staggered holes along the pillar line. This modification is still in the experimental stage but offers the great advantage that the entire stope may be drilled in one operation and blasting done as ore is required. It should also be much safer than the bench method, as the ends of the drifts may be fenced off to eliminate the danger of men falling into the open part of the stope, and as the drill runners will not need to wear safety harness they will have greater ease and freedom of action.[4] The amount of drifting on the sublevels is increased, but slashing of the bench is eliminated. Another innovation at this mine is to drill a sublevel block out in advance and shoot on Saturday night, the average blast being about 10,000 tons. As the mine is idle on Sunday this allows a full day for all smoke to clear out.

Noranda has continued its experiments with a mixture of slag and pyrrhotite tailing for stope filling. One stope was filled, and after eleven months a test drift through it showed that it was so solid that it could not be removed by picks but had to be drilled and blasted. The pyrrhotite oxidizes to a hydroxide of iron, which serves as a binding material giving a concrete-like mass. The heat given off is not sufficient to affect the mine atmosphere adversely. The mixture used consisted of 12 per cent mill tailing, 38 per cent crushed slag, and 50 per cent granulated slag.[5]

At the Sullivan mine, in British Columbia, the problem of filling large stopes on a very flat-dipping vein has been solved. Concrete dams are placed at the low points in the stope, with provision for draining off water, and a raise is run from the highest point of the stope to waste passes connecting with the surface. Soil and gravel from the surface are passed down into the stope mixed with sufficient water to make the mass flow into all parts of the stope. The amount of water added is usually about 20 per cent, increased to as much as 50 per cent where the gradient is very flat. This gives almost complete filling of stopes without expensive "stowing," and it is believed that the mixture of clay and gravel will consolidate sufficiently to permit pillar recovery.

A novel method of shaft sinking was brought to a successful conclusion at the mine of the Idaho-Maryland Company at Grass Valley, Calif.[6] The new No. 2 shaft, 5 ft. in diameter, was sunk 1,125 ft. through varying types of rock by boring with a specially designed core drill. This shaft is to provide ventilation and a cage for handling supplies. The effective cage area is estimated at 80.1 per cent of the total area and the shaft has perfectly smooth circular walls. In good ground no lining was required; in fractured or swelling ground a moderate thickness of reinforced concrete was sufficient to support the circular section. Despite troubles and delays, the costs achieved are decidedly good and compare favorably with costs obtained in sinking by drilling and blasting.[7] The total cost of the completed shaft was $42,114.41, which included the cost of headframe, hoist house, transformers, pipe, light and signal lines, and an item of $5,333.58 to cover the cost of the boring machine. Presumably this charge is excessive, as the machine could be used for future jobs. The direct charges of shaft sinking, for labor supplies, power, and miscellaneous were $23.57 per foot of advance. During a period of 35 days, after lost time due to experimentation and equipment failures had been pretty well eliminated, the direct cost of sinking was $13.79 per lineal foot of advance. As a result of the experience gained, it is felt that holes can be drilled up to 6 ft. in diameter and to a depth of 1,500 ft. in one operation. The shaft sunk produced 7,000 gal. of water per day. The types of rock drilled included "an abrasive gabbro; swelling ground; gouge, blocky serpentine; and firm serpentine."

Drill bits are receiving a great amount of study and experimentation. Detachable bits continue to gain in favor slowly, but there is still a great multiplicity of types, with confusing claims as to the relative merits of each. As yet there is no unanimity of opinion either as to the superiority of this form of drilling tool nor as to the proper design of detachable bit and shank. The United States Bureau of Mines has made a survey of detachable bits and has issued two progress reports.[8] Among the users of the old-style bits hot-milling of the bits after preliminary forging is gaining in favor. The milled bit is truer to form and gage than the forged one and is said to drill longer. This has had its widest application in South Africa, and is now used in a number of Canadian and a few American mines. Hot-milling is simple and inexpensive.[9]

In American quarries, particularly slate, the use of wire-rope saws is becoming more general and shows many advantages over channeling.[10] It is interesting to note that a method which has been so successfully used in Europe for over fifty years has been so slowly adopted in progressive America. The wire saw costs less than one quarter as much as channeling machines of like capacity and with the same labor cuts six times as fast. It uses only a small amount of the power required to operate with channeling machines and causes only one-third as much waste. It is estimated that the cost of cutting with the wire saw is only about 10 per cent of the cost by channeling. Not only is the wire saw proving its usefulness in the quarry, but it is finding an application in the yard and mill for roughing out blocks, cutting into specified lengths and trimming.

Tridimensional maps of mines have proved so helpful in the study of complex ore occurrences that their use has greatly increased in recent years. The drawing of these maps presents considerable difficulty, particularly where they cover large areas. Preparation of such a map of the Kolar gold field, in India, led to the development of technique and apparatus of

considerable interest to mining engineers and draftsmen.[11]

A new instrument called the "Thermal Precipitator," which is said to catch all fine dust, has been brought out by the British Government.[12] In the sugar method and the konimeter, or grease-spot, method all the comparatively harmless coarse dust, but only a part of the dangerous fine dust, is caught. As a coarse particle weighs much more than a fine one it has been long felt that measurements by these methods were unsatisfactory and gave unfair comparisons. The thermal precipitator should, therefore, be a great aid in the study of dust problems which is now receiving so much attention in all mining countries. It is based on the principle that dust is repelled from a hot surface and precipitated on a cold one. A thin wire placed between two glass surfaces is heated electrically, and when dusty air is passed through the instrument the dust is repelled by the hot wire and precipitated on the cold glass plates. It is claimed that the instrument catches all dust between 5 microns and 1/10 micron in diameter.

The use of electric cap lamps is increasing rapidly in metal mines. Relative freedom of danger from fire and of injury to men is responsible for their rapid replacement of carbide lamps. The only hazard from the storage-battery lamp is spillage of the battery fluid, which may cause skin burns. Undoubtedly it has great advantages over the carbide or oil lamp and will soon supplant it in metal mines as it has in the coal mines.

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METALLURGICAL PROGRESS

A Broad Survey of the Vast Non-ferrous Field Shows Many Changes

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METALLURGY and civilization advance only side by side. Metallurgy subsists on the demands arising from civilized life. Civilization hangs suspended from the framework that metallurgy provides. We must read our progress not in mere activity but in what metallurgical enterprise is empowered to do under its own driving force and great resource.

We may expect an increase in metallurgical science so long as books, publications, societies and research bodies, colleges, government bureaus, and corporations minded to research, facilitate its growth, and so long as social needs give real objectives. New doorways to discovery are being constantly revealed. We are developing a degree of discrimination and analytical understanding never before so evident in the industry. It is extending to the public mind. Thirty million automobiles are making metallurgists of us all. The old materals no longer suffice for any modern purpose. New ways in construction require new methods, new tests, more precision. A new technical world has emerged in the fraction of a generation. The impetus for these recent changes has been started mostly by the consumer. The metallurgy, which has been evolving steadily, is perusing its records and drawing upon its capacities as it never did before, with new tasks now given, and encouragements it previously never had. The effects and responses which its vision may reveal are the indicators of the trend of progress. Under the impetus we should liquidate some of society's investment in education.

First of importance, in this period of recovery, has been the demand upon metallurgy to produce strong metals. In response, metallurgy has required that we define what strength is. Science then can discover how to get it. We have been lax in defining what the qualities of strength actually are. Tensile strength, hardness, yield point, elastic limit, fatigue resistance, time and temperature alterations—all are qualifications in the service of metal where discrimination is imperative. Nor has there been sufficient precision in the determination of these qualities for purposes that we are meeting in the present year. The minor influences of composition are receiving more attention, and the structural changes that produce them. We are doing much but there still is a long way to go. Until we can be assured of quality-control in metal throughout welding, casting, forming, fashioning, and surfacing, the highest development of our high-cost, high-speed, high-flight mechanisms will have to wait for progress in this knowledge. Through elaborate heat-treatment and cold-rolling, strength is expected to endure. The knowledge of time, shock, and the influences of temperature, and the diffusion of metal components into solid-solution aggregates, is receiving much attention, as it should. Correct chemical analysis has now become more than ever imperative and metallography has become an involved specialty giving character to the methods of our advancement. Young men are being trained who will be guardians of our industry. The training is deep, and the teachings are the key to the direction of the progress being made.

Corrosion resistance further rises to public attention. The past year has given us much evidence of it. Our standards are being correlated, crudely though it may be. The corrosion resistances of the many metals, and of their multitudes of alloys, in their varieties of crystalline state, are being studied in their state after casting, forging, cold-rolling, or heat-treatment. These countless varieties of metal meet the endless variety in environments. There are atmospheric, aqueous, saline, acid, alkaline, and organic agencies as well as temperature, and stress from within or without, along with electrolysis, to be taken into account. The problems are being disentangled

notwithstanding permutations to the point of consternation. They arouse popular attention in the food industry, and engineering attention in most structural employment. They are critical in the fabrication of chemical and manufacturing appliances. Corrosion-resistance tests and comparisons are at the heart of extremely serious problems involving high values in steam- and water-distributing systems, for public and domestic supply, involving durability and economy. We have as yet no defensible resolving system of judgment by which the conditions that cause the corrosion can be systematized scientifically. Metallurgy is continuing to struggle in this need, with empirical observation. The salt-spray test, for example, has justification in offering conditions roughly parallel to the effects encountered in actual service, but the conditions are widely varied and difficult to define. A vast accumulation of data is at hand, but the proof of the metal often still is in its use, with such records as have been kept. For all this there are deeper principles actively growing out from our understanding of molecular structure. Progress is being made in laboratories in the refinements of chemical equilibria of metal components in reaction with environment. We are approaching a scientific system of generalizations, and these are applicable to economic problems.

To meet demand with not prohibitory cost, the metallurgist and the miner, aided by the manufacturers of equipment, are rendering service by marked improvement of many machines, conveyors, appliances, and mechanical controls. Efficiency-research of every kind to relieve the laborer and dispense with his high wage is active now. To select the right metal for each given use is a constant problem in economy, and a draft upon what we know of physical constants of all metals under all conditions. But it has to do also with grades and qualities in which we are rapidly progressing now. Each year publication renders data more easily accessible. Confusing proprietary names are going out of favor. The clear statement of the purity of metal products by the producers of them, and of the exact content of the minor components in alloy, are being made more fully by manufacturers, who often are the larger producers of them.

Reduced costs of production are admitting a greater variety of metals to favorable consideration in all selections of metals for definite use. Beryllium, for example, now awaits further industrial application. In half a decade, as a result of enterprising research in which the late William H. Bassett took a leading part, its price has been greatly reduced and its consumption materially increased. The service of the metal is in alloys of copper containing not more than 2.25 per cent of the beryllium, to which it imparts a tensile strength, under heat-treatment, approaching 200,000 lb. per square inch, together with corrosion-resistance, high conductivity, and the elasticity of spring steel. Such alloys are best produced from a master alloy of copper running 5 to 12½ per cent beryllium, which is less costly to produce and apply than pure beryllium. They are offered now on the market and will serve many special uses. Beryllium-nickel, which is considerably stronger, is at present of less service because of difficulties in its working.

MODERN METALLURGY depends to a greater extent on instrument control, as typified by this panel from which the coking operation in the vertical retort process of the New Jersey Zinc Company is governed

Many common metals could easily have been great rarities. The superior work in separation and production of the platinum metals at the Baker plant is noteworthy. We are giving more heed, also, to the very minor possible content of the platinum metals where suspected of being present. Such metal is not wanted at the mint, and when present, as sometimes it is in bullion from hydraulic mining, or elsewhere, it passes uncredited to any party other than the mint itself. Costs of metals primarily result from the scarcity of ores, but the idea of ore is relative and the development of metallurgical methods laborious and slow. Aluminum, for example, is everywhere. Through improved metallurgical skill more kinds of metal-bearing rock are now made workable for the metal known to be contained. A greater number of very low-grade ores are now being treated profitably.

Taxation, labor obstruction, secrecy, monopoly, and the inadequacy of knowledge clearly hold the average of metal costs higher than they otherwise would be. A long-enduring low price of useful metal, however, should never be regarded as a hardship to industry as a whole, or in the end to mining or metallurgy itself. It means abundance of the raw material, and accomplishment in methods of production, but, of equal importance, it means a broad possible application to varied use over an extended field. It ushers in a higher degree of practice that comes from the close adjustment of scientific method to economy and costs through engineering skill. The long-continued comparison of economy between retort processes and the hydrometallurgical extraction of zinc vacillates, for example, from one viewpoint to another. At present the new vertical retort, developed by the New Jersey Zinc Company, is presenting features to favor the older principle where applied in favorable circumstances.

We have done much to develop the use and service of many of the long-known metals in production. For example, nickel, copper, silver, and zinc have gained in production and use through artificially stimulated acquaintance with their worth. The increase in domestic consumption is a mark of substantiality of far higher permanent value to the industry than perhaps exportation.

Though we look upon increased demand as the prime stimulus to activity, in the past year we may count as a substantial gain in permanent values the increasingly constructive attitude of engineers and scientists behind the machines. Discoveries of great economic potency are receiving the treatment of the most competent of our practitioners. In all advancing science, origination often starts with seemingly trivial inquiries. The metal industry now possesses various sorts of these. We may take our method from the knowledge of the past. Pupin and Ford and Wright and all the others from Archimedes to Lawrence, of California, breaking atoms with his cyclotron, have been required to develop their theories first in their solitary way. Some of the prevailing metallurgical dreams are visionary and will die. Others are directly consonant with development.

We cannot highly appraise the ocean as a source of gold, because we know the cost of energy; nor can we see in the transmutation of elements anything of economic significance under terrestrial conditions as a source of gold. Perhaps one of the gains of the past year has been the pruning of certain popular expectations in these unrestrained visions. But the X-ray analysis of metals, just now, permits us to detect blowholes and imperfections. More important than such present use, however, is a deeper study which the X-ray and cathode ray usher in, offering the means of examining the molecular structure and physical state of the metallic elements, and thereby

making possible a basic acquaintance with their relations and action that we have not had.

The study by X-ray analysis has now grown, since the days of Röntgen, until it is a specialty requiring years of attention by those attempting to work productively upon it. Here is a cult that takes tangible application in those many problems of metal structure that have been too complex to contemplate by any other means. Heat reactions also, along with calculated energy and entropy, are eliminating much dull experimentation, as did the deductions of Newton and Carnot in clarifying perpetual motion. The work of Maier on zinc, at the Bureau of Mines, bristles with opportunity. Spectrum analysis may displace the use of test tubes and possibly of burettes and balances in many types of investigation. Phase studies and diagrams reveal, on a page, what would otherwise require the space of books. In some cases our findings merely confirm what we had long known, but our methods, developed within recent times, show at will the way to produce qualities that we desire. Few of the metals that nature has given us are used in applications most needful of them. Their application to appropriate uses is receiving more rational guidance, but a part of the accomplishment in recent time rests in wider acceptance of the engineering dictum and a deeper popular appreciation of the value of scientific approach.

Production and Uses

The wise production of metals is found inseparable from the wise use and judgment of them. Production remains a matter of sources, markets, economies, and costs. The motive to reduce costs of production, secure profits by well-chosen processes, obtain rewards, and reduce waste appeals to us all. All have cooperated in securing the improvements that the industry has made from the scientist who has opened the way to the economist whose business it is, and to the engineer who executes it. Some of the improvements have been in mere mechanical arrangement and design. Credit is due the many existing manufacturers of the new, splendidly designed, and well-constructed machinery for crushing, grinding, and sizing ores. There are improved conveyors, gates, elevators, feeders, weighing devices, concentrators, and flotation machines, all of superior construction and principle. There are improved appliances for casting and for dust collection, and changes in the drawing off of slag.

The great ore-treatment industry is a composite of little matters, each relatively small to mention, when once observed, yet, in the total, helping to augment the factors of progress that characterize our practice. Most of these improvements are broadly known, interchangeable amongst producers, and in the possession of growing practice as a whole. Some become private possessions through patent rights, seldom remaining long parasitic on the trunk of progress. Inventions, and announcement of their success, appear each day and month, characterizing the originality and ingenuity of practice under the conditions of natural and free development in America.

Flotation's Role

Most marked is the improvement along the border line between ore dressing and metallurgy. Changes have come about here that have relieved smelting of many of its woes. Flotation has aided most strikingly in this, while, in turn, it has itself been rendered extensively possible through the improvements in fine-grinding machinery, better ball mills and liners, changes in classifiers, and the great development in power generation through oil exploitation and distribution, and the improved hydro-electric installations. Better knowledge of what flotation can do, and more precise explanation of why each reagent acts, are massive gains in an involved technique that already has accrued. There is, however, now to be seen, a limit to the indefinite extension of flotation to application. Isolated mineral grains cannot always be released from disseminated and diffused ores. Solid solutions of minerals prevent separation, however fine we grind. Ores sometimes are variable in their components, too, in stopes closely adjacent, and special flotation conditions cannot yet be rapidly altered to meet rapidly shifting needs in adaptation to all variant kinds. Pyrolusite will not entirely separate from magnetite, nor sphalerite from pyrrhotite, nor gold in many cases from the hematite that accompanies it.

Amalgamation after fine grinding is subject to the same limitations as are those of flotation. For years electrolytic or electrostatic potential has been sought in place of sodium or other chemically acting agents, as an aid or accelerating force in amalgamation to release gold from its accompanying mineral. Shepard, of Stanford, has carried this effort forward to a point enabling him to define certain optima in working conditions. Electro-potential influences, however, and other mild atomic forces, effective in some measure, are found incapable of rupturing the disseminated gold from the attached and adhering gangue of many ores.

In the recovery of gold, and also of many other mineral elements, chemical extraction is the recourse being favored in numerous instances. The Merrill-Crowe vacuum principle with further and very recent improvements in the system, along with the precipitation factor, is bringing relief in the cyanide extraction of gold. Appliances for dewatering, thickening, agitating, filtering, decanting, and clarifying remain for the most part unchanged in practice as a whole, although highly developed design and workmanship characterize the equipment and supplies now used. The hasty though imperfect extraction of gold from ores carrying serious cyanicidal elements is being employed in certain minor plants for expedient temporary operation. Chemical conditioning and special types of roasting are receiving attention, with promise of improved recovery, in the treatment of several metals which are rendered suitable for extraction with suited solvents. Such chemical extraction looks frequently now to combination with flotation, employing chemical action extending beyond the limits of physical metallurgy. Outstanding successes of this sort are always specific in each instance, among complex and refractory ores. In fact, definite processes of chemical extraction or of flotation are never transferable, *in toto*, from one ore or one locality to another. The real object for attention, therefore, is the ore, and not the process. Practice has come to know that the recovery problem, pertaining to any ore, runs the entire gamut of metallurgy, and that the full resource of metallurgical possibility has only begun to be revealed.

Each metal usually has some characteristic that seems to fit it best for some one of the standard types of treatment. Easily soluble metals or minerals naturally seem suited to processes of lixiviation. Fusible metals indicate smelting or liquation. The trend of practice, normally expected, would follow a course to utilize these notable qualities. The trend in experience has usually been in such directions, but not universally. A sense of security is gratified, generally, by any drift in popular adoption that follows the direction of rough simplicity.

Some Characteristics

Mercury, which boils at a temperature below a red heat, brooks no competitor with the simple volatilization of the metal such as any process of chemical extraction or concentration would be. With the Cottrell fume-collection system, with condensing conditions and materials now well known, with retort, furnace, and kiln development now greatly advanced, we feel that present practice is directed on the course of highest economy. Other metals, capable of yielding volatile chemical compounds of the desired metal, through simple reaction, offer encouragement always to processes of volatilization or sublimation for metal-

lic separation. Arsenic is commonly so recovered. Nickel, yielding the highly volatile carbonyl, has been favored with advantages in the Mond process. Chromium and other metals are promising to come under a volatilization type of treatment. Processes of this type each year have been seriously contemplated, some of which are for precious as well as the base metals of low value. Antimony, on the other hand, is drifting away from this type of recovery, which for it is old, reverting to antimonial lead smelting in some of the largest new installations. The condensation and subsequent separation of the distilled or sublimated products is the usual impediment in these cases.

Metals of low melting point, when permitting of easy reduction, should promise permanent preference for simple smelting. This should apply to lead and tin. And here again is the process by which these metals now are treated generally. The difficulties lie in the slag and less fusible products that are difficult to control. Flotation has done much to alleviate these difficulties, but it has not done all. Here, too, there are volatilization losses of values, and needed diversion of procedure to recover the accompanying metals that engender complications destroying the seeming simplicity of the fusion or smelting process. Electrolysis, in competition with lead smelting, suffers by a natural handicap, yet in spite of cost, complexity, and power, the Betts process is gaining ground and is being installed in some of the large new enterprises. Copper, though requiring high temperature for fusion, by itself or in its compounds, is so suited to the matting process for the treatment of the concentrate, which usually can be obtained from many low-grade copper ores by fine grinding and flotation, that it is being so produced, and only in exceptional cases brought to the resort of hydrometallurgical extraction.

Metals that permit of recovery by amalgamation, in which gold leads, of course invite this simplest means of all for the recovery of the minute component. Physical conditions arise, however, that prevent a full recovery from most ores. The practice is declining from favor in large-scale operation. Smaller operators, however, for a long time to come, will find its simplicity and low initial cost profitable and most expedient. Flotation here may supplement recovery, but an entire change to flotation is now being made in many places, in spite of the fact that many limitations still remain under the best practice in gold flotation. Chemical extraction is often applicable for the recovery of gold and sometimes of silver. With many wise metallurgists, and for many ores, it remains in favor.

THE NON-METALLICS

A Decided Swing to Processing and Production of Super-Quality Materials Is Visible

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NO ONE PERSON KNOWS all the non-metallic minerals and no one ever will. Any mineral in the textbooks of mineralogy that can be sold in regular trade channels, and that is not already a metal or intended to be reduced to a metal, is a non-metallic mineral. In this review, only the solid mineral substances whose procurement and beneficiation have come under my recent personal attention will be discussed.

Froth Flotation—In the past few years froth flotation has been the most extensively used tool for preparing minerals so that they would be suitable for market purposes, and it now takes its place in competition with gravity-separation methods, magnetic and electrostatic separations, screen sizing, water classifying, and air elutriation. Froth flotation has been adapted from the metalliferous industry, where it was developed, and in spite of the fact that it has been adapted to about thirty non-metallic minerals, most of the non-metallic industries are not even cognizant of its existence. One must insist on calling it *froth* flotation, because in many industries water classification and sedimentation methods are called "water flotation methods" and air elutriation as a separative process has been called "air flotation."

The adaptation of froth flotation to adjustment of composition of a cement mix for a "wet" mix proved to be just the missing element of control at the Valley Forge Cement Company plant near Valley Forge, Pa. Today about 1,000 tons daily of cement mix is ground wet and treated by froth flotation to discard whichever mineral is present in excess. Actually, the total mix is divided into four fractions, which are then recombined into the proper proportions to give the correct mix. The success of this plant has caused the formation of a new firm of consulting engineers at South Bethlehem, Pa., who are now designing plants for other cement companies and lime companies. They state that they have six important foreign plants soon to be constructed. Before their work, the general impression was that cement rock or lime rock was simply too cheap an article to justify processing by such an operation as froth flotation.

An even greater user of froth flotation is the phosphate industry of Florida and Tennessee, in which the total daily tonnage treated probably approaches 3,000. In this case siliceous material is discarded and the calcium phosphate thus graded up. This makes possible mining and utilization of material which was formerly waste in the phosphate fields. The application of froth flotation is now several years old in this field. The phosphate industry was the first large non-metallic industry to take up the process.

An even earlier user of froth flotation was the fluorite industry of Kentucky-Illinois, Fluorite responded to some of the reagents commonly used for metalliferous minerals and therefore the first attention was given to recovery of fines commonly lost in tailings. Also, fluorite is commonly associated with a considerable number of other minerals of about the same specific gravity, so that gravity methods of concentration had been very imperfect. By froth flotation it was possible to grade up a low-grade product to "acid spar." By this is meant a concentrate suitable for production of hydrofluoric acid, and usually this indicates well over 95 per cent purity.

Clays are commonly impure or made up of combinations of clay minerals in incompatible proportions, which cause beneficiation to be awkward and difficult. Removal of impurities from clays has long been the goal of flotation experimenters. Many clays have been tested for removal of discoloring materials, and frequently this has been done successfully. Sometimes removal of specks of iron minerals has caused most of the plastic portion of a clay also to pass into the froth with the undesired minerals, and the remaining clay, though light-burning,

has insufficient plasticity. At a meeting of the American Ceramic Society and the American Institute of Mining and Metallurgical Engineers in State College, Pa., a paper was read by Dr. M. I. Shaw, of Ohio State University, on flotation processes for the removal of limonite and pyrite and other speck material from an Ohio clay. Froth flotation was not well adapted to this clay, for the reason already set forth, but an early flotation process known as "skin" or "film" flotation, developed by A. P. S. Macquiston, and for which the "Macquiston tube" was invented, proved well adapted to the removal of the speck material without removing any of the clay minerals. Shaw's paper has not yet been published. Shaw did not use any of the more modern reagents suitable for nonmetallic minerals.

Clay fractionation is an idea which seemingly has been tested only by my coworkers and myself in the Bureau of Mines. The clay is rare that consists entirely of one clay mineral in a definite range of dispersion. Clay mineralogy has lagged in practical application until the past ten years, since the X-ray came into more general use for determining the crystallography of clay minerals. Now the mineralogical analysis of clays is forging ahead rapidly, and one may now say that no two clay banks are alike because: (1) they differ in the kinds of clay minerals present; (2) they differ in the proportions of the clay minerals to one another; (3) the degree of dispersion of the various clay minerals varies; (4) the incidental impurities present in small-particle size, such as quartz, feldspar, mica, and similar materials, vary. Instead of accepting these clays for what they are and using them either with no washing or with a minimum of removal of granular material, why is it not now time to divide clays into their mineralogical fractions by a process which is capable of mineralogical selection? The deflocculation and sedimentation processes, which represent the best clay-washing practice, are adapted only to making size separations. When the various sizes of material in a clay happen to represent different clay minerals, only then is mineralogical fractionation possible. The collecting and frothing agents used in flotation can be chosen to film certain mineral surfaces selectively, causing them to become more or less water-repellant and to adhere to air bubbles. With this in mind, the New Brunswick and the Tuscaloosa Experiment Stations of the Bureau of Mines are undertaking investigations of this complex subject. R. G. O'Meara, of the Tuscaloosa Station, spent many months in the field, especially at Spruce Pine, N. C., in cooperation with the Harris Clay Company, at its test plant, and at the Tennessee Valley Authority ceramic laboratory, which examined the clay fractions as to utility. A report on this preliminary work will be forthcoming, but for the present it is well to say that froth flotation will make every separation that can be made by deflocculation, and more too. Other clays are under investigation.

Talc is a mineral that will float almost without flotation collectors. All

Three Non - Metallic Minerals. "A," Powdered sericite. "B," Powdered pyrophyllite. "C," Specially micronized talc. Magnification is 80 diameters. Whereas the powdered talc would look very much like the other two, when micronized it develops a much more fibrous structure

it needs is a frothing agent. In fact, it can rub off onto other minerals and make them float too easily. Therefore, as discovered in the Rolla Experiment Station of the Bureau of Mines by J. B. Clemmer and S. R. B. Cooke (see Report of Investigations 3314, United States Bureau of Mines), modifying agents must also be added to restrain flotation of the less talcose minerals. Clemmer and Cooke worked with a talc contaminated by magnesite. United States talcs vary widely as to their associated minerals, and little pure talc is actually available from American sources; hence, the need of froth flotation to supply these needs and to make improved products for the established users who take impure talcs. Work on the other talcs is going on at New Brunswick and Tuscaloosa.

Spodumene, a lithium aluminosilicate corresponding to leucite in silica-alumina ratio, is the principal lithium mineral in the United States, so far as tonnage is concerned. Huge pegmatite dikes in South Dakota and North Carolina assure ample supplies of ore and carry enrichments that can also be mined selectively. However, the main mass of these ores require concentration to become of economic utility. Gravity concentration and flotation concentration have been tested at the Rolla Experiment Station of the Bureau of Mines, and a covering report will soon be off the press. Though spodumene has a favorable specific gravity, it breaks into slivers which largely nullify its weight for any gravity concentrating process; consequently, only a very low extraction of satisfactory-grade concentrate is possible. However, the flotation concentration process was acceptable and gave good grades of concentrate with fair recovery. At the New Brunswick station an entirely new process of concentration is also under test.

Feldspar deposits in the Appalachian belt are being rapidly worked out, and Western production is increasing. The mixtures of feldspar and quartz that occur along with the feldspar have only limited sale. Glass manufacturers and potters refuse to buy more than a limited amount of these mixtures, because they are variable in feldspar:quartz ratios and necessitate chemical analysis and refiguring of mixtures with every shipment purchased. Therefore, it seems that separation of the two minerals is needed in spite of the fact that both the potter and the glass manufacturer put quartz back into the mix. It would seem reasonable to suppose that, if the feldspar producer were to stockpile feldspar-quartz mixtures of known content and blend them to a guaranteed ratio for each customer, he would escape with less investment in plant than if he were to separate the two minerals and sell them separately.

However, interest in feldspar beneficiation by means of flotation continues, and the literature on laboratory separations grows. The trouble with most of these separations is that they float the feldspar away from the quartz. If the ore consists mostly of feldspar and quartz removal is the real problem, it is preferable to float the quartz, so that the flotation operation need not be too long continued. The

trouble with soaps and similar reagents, wherein the "greasy" collecting ion is an anion, is that they attach themselves to the more basic minerals. On the theory that a separation from quartz demands the opposite kind of collecting agent, one in which the complex greasy ion is a cation, several cationic reagents were tested and were quite successful in floating away the quartz from an impure feldspar, leaving the feldspar as a tailing. Mica tends to float out ahead of the quartz with this type of reagents. This work was done by the Bureau's Non-metals Division, R. G. O'Meara being the experimenter.

Mixtures of soluble salts were once separated only by dissolving them and fractionally crystallizing. Froth flotation of the separate crystals in a saturated brine is now the rage. Starting at that hot-bed of non-metallic mineral flotation separation, the Bureau's station at Rolla, a wide variety of separations is now under test throughout the world. Members of the Rolla staff have been "aces" in non-metallic separations. They tried the separation of sylvite (KCl) from halite (NaCl) in the sylvinite ores of New Mexico-Texas. By accident they early hit upon the most successful reagent for this separation, sodium octadecyl sulphate, known in the trade as "avirol 80." This is a wetting agent which ionizes into sodium ions and complex long chain anions. This reagent causes sylvite to float away from the other impurities in the ore; the sylvite, being slightly pink, gives a pinkish froth, which turns white as soon as all the sylvite is floated. A. J. Weinig, of the Colorado School of Mines, also worked out a separation for the same type of ore, using an oleate type of reagent, and obtained flotation of the halite instead of the sylvite. This has been put into operation at one of the Carlsbad, N. M., potash mines. The flotation of the halite away from the sylvite leaves the latter contaminated with the other constituents of the ore, and seemingly this must be purified by fractional crystallization, whereas the Rolla separation gives a cleaner potassium chloride direct from the flotation machine. In Soviet Russia a similar flotation separation of sylvite and halite is under experimental investigation in a pilot mill, and a large flotation plant is planned.

At Rolla, F. D. deVaney and S. R. B. Cooke (Report of Investigations 3300) have also worked out a flotation recovery of langbeinite, a double sulphate of potassium and magnesium, from the other salts of the potash salt beds. The Russians have worked out separations of borax and boric acid from sodium chloride crystals, sodium chloride from sodium bicarbonate, sodium chloride from sodium nitrate, sodium chloride from potassium nitrate or potassium sulphate, or sodium normal carbonate or magnesium sulplate, but only the first three have been made really effective separations.

This separation of crystallized masses in their mother liquors has also been extended experimentally to salts and salt mixtures prepared by fusion. Fusion of siliceous alumina ores with lime or soda, followed by separation of alumina and/or silica by precipitation with CO_2 (which forms $CaCO_3$ or Na_2CO_3), leaves a mixture from which the $CaCO_3$ precipitate can be easily floated by use of oleates. Summarizing, a whole new field is opened up. Salt deposits which were formerly of little value, due to the complicated processes needed for treatment, now give promise of permitting useful separations.

In other branches of the chemical industry, flotation has come to be a useful tool for concentrating dilute suspensions. Precipitated sulphur, from the oxidation of H_2S by air in the Koppers Company Thylox process, is carried into a froth by the very air which does the oxidizing and the froth skimmed off and filtered. In the paper mills a flotation "save-all" is found possible. In the sugar mills, froth flotation carries off from the juice some of the material which normally causes high molasses residue.

Tabling and Agglomeration Combine for Service

Agglomerate Tabling—Wet tabling of agglomerated pulps is another closely related subject. Those familiar with the early history of froth flotation recall that A. E. Cattermole invented a process of agglomerating slime minerals into large masses by use of an excess of oil over that used in froth flotation. By gentle rolling of the pulp the sulphide minerals were rolled into little, fragile balls that could be screened out or otherwise removed. Now that reagents are available for collecting carbonate and silicate minerals into froths, the same reagents can be used for greasing the surfaces of the desired minerals, after which an addition of a crude oil amounting to 10 to 20 lb. per ton of ore can be made, and the minerals which have been selectively greased by the flotation collector are then gathered into floccules, spheres, and other shapes by the crude oil. Just as in flotation, the pulp must be properly modified so that only the desired minerals are agglomerated. This pulp, put onto a wet concentrating table, is separated by the cross flow of water on the table. The agglomerated material sticks up into the sheet of water farther and is washed off the tailing edge of the table while the unagglomerated material can be caused to come off the concentrate end.

Agglomerate tabling is in use mainly on phosphates in Florida (Southern Phosphate Company, Phosphate Recovery Company), where it has to a certain extent displaced froth flotation. However, it is a process limited mainly to granular material and in fact works best on material between 20-mesh and 100-mesh size. Slimes must be treated by flotation. (R. G. O'Meara and J. W. Pamplin, Report of Investigations 3195). Cement raw materials have likewise been tested by this method in cooperation with the Atlas Cement Company (F. P. Diener, J. B. Clemmer and S. R. B. Cooke, Report of Investigations 3247) by the Rolla, Mo., Experiment Station. Unpublished work from the Tuscaloosa Experiment Station shows that kyanite can also be treated in this manner. The fluorspar mills at Rosiclare, Ill., are also working on the subject. For all the calcium minerals, the use of soap as filmer and crude oil as agglomerator has been successful. The method shows promise of extension to all the minerals that can be froth-floated.

Kyanite is being concentrated by gravity methods in Burnsville, N. C., and Clarkesville, Ga., the former being the dry-air table plant of the Selo Mines, Inc., and the latter at the Sutton Mill Creek plant of the Georgia-Carolina Minerals Corporation, a wet concentrator. About the best grade of kyanite produced by these plants is 90 per cent pure. Froth flotation can give better extraction and much higher grade of concentrate than any of the gravity methods. However, many of the refractories manufacturers object to flotation concentrate because in the making up of brick they have no coarse grog. The New Brunswick Station is looking into the processing of flotation concentrate to convert it into coarse grog or otherwise make it desirable.

Mica that formerly went to waste in many plants producing other materials is now being recovered, mostly by screening out mica flakes, while the more granular materials pass through the screens. Also, new operations have been initiated at a number of points. At Spruce Pine, N. C., the Harris Clay Company has long screened out fine mica from its kaolin deposits. The Southern Mica Company, at Spruce Pine, is hydraulicking a stained clay bank and crushing the coarser material in alternating rolls with screening out of mica between sets of rolls. The Victor Mica Company is building an addition for the dry grinding of a mica schist in order to screen out mica. The Georgia-Carolina Minerals Corporation, in its kyanite plant at Clarkesville, is recovering several tons of mica for every ton of kyanite concentrate made, as the kyanite occurs in a mica schist. All of these products are marketed as ground mica for such purposes as roofing. If graded up to remove more grit it enters

higher-priced markets. At the Tuscaloosa Experiment Station it has been found that very excellent concentration by froth flotation results when the newer cationic reagents are applied.

New clay-washing plants are being built at Spruce Pine to provide a better potters' clay. The Harris Clay Company is tuning up its new mill near Micaville, and Kaolin, Inc., is just completing a similar mill on the other side of Spruce Pine. In both of these the desirable grade of clay is obtained by deflocculating with alkaline solutions and then sedimenting out granular kaolinite, hydromica, fresh mica, feldspar, and quartz in the order named. The suspension of clay is then reflocculated with acid and filtered. Close control, with automatic recorders of temperature and pH, is necessary to make a completely reproducible product. Large storage capacity in thickeners and filter tanks is also installed to permit blending of product from a number of days' work before filtration takes place. Reliable, constant grades of high-grade kaolin, equal to the best Czechoslovak clay, are anticipated.

The American Colloid Corporation, of Chicago, mines bentonite in Wyoming and South Dakota. It has added a plant for crushing and sizing bentonite into granules of closely regulated size. These sizes are so chosen that the bentonite will slake completely as it drops into water.

The old dry-grinding pyrophyllite mill of the R. T. Vanderbilt Company at Hemp, N. C., has been replaced by a new wet-grinding plant.

A similar mineral is sericite, which is beginning to make a bid for some of the filler trade in competition with pyrophyllite and talc. Pure white grades of soft sericite are available, whose small particles are fibrous and ought to be of special value in certain parts of the filler trade.

The tripoli industry has been hit by buyers' resistance on account of the silicosis scare. The Barnsdall Tripoli Company at Senaca, Mo., has built a large experimental mill for making powdered pumice from a New Mexico source to substitute for tripoli or supplement it.

Garnet concentrates are being made in the kyanite plant of Selo Mines, Inc., Burnsville, N. C., and marketed as sand-blast grains especially for carving of letters and figures in the monumental stone-working trade. For sandpaper only certain special garnets are used. These special grades break in flakes which can be dropped onto glued paper through an electrostatic field. The electric forces orient all the garnet grains with their points upward, and the grains are also dispersed uniformly over the paper, due to their mutual electrostatic repulsion. This "electro-orientation" of grains and fibrous material promises to enter a number of other important industries.

Bleaching earths are now being synthesized by activating clays in competition with the natural fuller's earth. The work of P. G. Nutting, of the United States Geological Survey, has rationalized the technique of clay activation, and now there is a scramble by numerous companies to produce and market better grades of bleaching earth.

New feldspathoids for use in glass melting are under investigation or development. The spodumene mentioned in the foregoing is one of them. The principal one is nephelite.

In this paper some of the new machines under development must not be forgotten. In Kansas City, Dr. Roy Cross has been developing a "flipper mill" for reducing granular clays to colloidal consistence.

The International Micronizing Corporation, of Camden, N. J., has an abrading machine operated with high-pressure air or steam which carries finely divided particles into contact with the interior circular abrading surface of its "Micronizer." Shredding of a fibrous mineral into threads is one result.

The Separations Engineering Company, of New York, also puts out an experimental laboratory size of "Isodynamic" magnetic separator, designed by Dr. Franz. It can be arranged to do all ordinary ferromagnetic and paramagnetic separations in both low and high intensity fields respectively, but it can also be set up to repell diamagnetic minerals from a high intensity field.

Finally, whereas most non-metallic minerals were once regarded as materials on which very little money could be spent in processing, due to their low value, there is a decided swing to processing and production of superquality materials. Few mineral deposits are pure. Purity sometimes brings results that are worth money. Therefore more purification is in order.

FLOTATION

Firmly Intrenched as a Means of Concentration, The Art Makes Some New Gains

A. M. Gaudin
Research Professor of Ore Dressing, Montana School of Mines, Butte, Mont.

FLOTATION during 1936 was marked by a consolidation of recent advances without introduction of startling novelties. This does not mean that progress has been lacking. Indeed, the numerous contributions made to the literature of the subject indicate that there is considerable interest in this field of mineral dressing, with notable gains in theoretical understanding and wider application of the process.

Sulphide Ores—Flotation continues to be the principal method of concentration for base-metal ores. For the past several years, largely because of economic conditions, during the depression, there was no substantial new construction in that field, particularly in North America. It would appear that this stage is passing and that additions to plants, perhaps contemplated for several years, are now being made. Typical of this expansion in physical facilities is the increased capacity of the Midvale plant of the United Smelting, Refining & Mining Company, which is now rated at 1,600 tons per 24 hours. A few new base-metal sulphide flotation plants were put in service in 1936, notably the Mountain City Copper mill, in Nevada. An interesting account of an extension to the Broken Hill South concentrator, in Australia, has become available.

Selective flotation of base-metal sulphides continues to improve in quality. Even in the now standard lead-zinc selective flotation there is room for interesting findings, and selective flotation methods are applied to new combinations of metals such as molybdenum and copper, cobalt and copper, and mercury and antimony.

Gold Ores—Interest continues to be shown in the application of flotation to the recovery of gold. This trend, which was noted in my 1933 review of flotation, has continued to the point that even in South Africa flotation is finding a place. The enthusiasm with which flotation was being adopted for

gold saving as recently as two years ago is gradually giving way to a more mature and balanced weighing of the relative advantages of flotation and other means of gold recovery, particularly cyanidation. Joint use of flotation with cyanidation, amalgamation, straking, and jigging of ball-mill discharges prior to classification seems to be gaining ground.

Tray thickeners arranged in series for countercurrent cyanide plant operation have reduced the first cost of cyanide plants, and that process, which has always been handicapped by a large first cost, will be better able to compete with flotation.

Microscope Work—Progressive investigators and organizations realize more and more the importance of definite ascertainment of the mineralogical species, structures, and textures involved in ores treated by selective flotation. This involves, of course, the most precise kind of microscope work. In what concerns gold ores this is shown in the splendid report on investigations at the Lake Shore mill by that company's staff, as likewise in theoretical studies of gold in pyrite and in practical examinations of gold lost in tailings. A detailed study of the mineralogical flotation problems at Anyox has recently been published.

Coal—In the field of coal cleaning considerable expansion in the use of flotation is noted abroad, but not in the United States. This application is directed not only to the recovery of fine coal now lost in sludges but also to the separation by flotation of the various carbonaceous constituents of coal. Patents have been granted in Germany for the selective flotation of coal. It is to be noted that much of the recent work in coal flotation has been done in Germany and in Russia.

Oxidized Ores—In the field of treatment of oxidized ores of lead, zinc, and copper there is little to report. As has already been emphasized, this is because of the complexity and variability of the ores and the availability of competing treatment methods.

Non-metallics—The most speedily developing field of application of flotation is that of the treatment of non-metallics. The term "non-metallics" is, of course, used to designate mineral products which are valuable not for their metal content (although they may contain elements chemically classifiable as metals), but for some other physical or chemical reason. Examples are: potash salts and phosphate rock. In both of these fields interesting developments are being made, although the amount of information is small.

According to a recent description of the operations of some potash mines in New Mexico, the sodium salt is floated away from the potassium salt; a separation in the opposite direction is sought in U. S. Patent No. 2,046,312.

Flotation is used for the concentration of barite; it has been proposed for the concentration of kyanite, of vanadium-bearing minerals, and for other separations among non-metallics.

In Cornwall, flotation is used to purify the tin concentrates. Here sulphides are floated from cassiterite.

For the concentration of phosphate rock, agglomeration continues to be practiced with flotation. This process consists in forming loosely bonded agglomerates of the agglomerable minerals and air bubbles while not agglomerating other minerals, and in the subsequent separation of the relatively coarse and light agglomerates from the relatively fine and heavy non-agglomerated particles. The process is described in U. S. Patent 1,968,008.

Chemical Uses—Flotation is also used now for the removal of carbon from waste paper pulp, preparatory to the re-use of this pulp. Other applications are said to be in the making, in the field of the chemical industry, but little information is available.

Reagents—Developments in the line of flotation reagents include several compounds introduced under trade numbers which are stated to be at least equal in value to xanthates and dithiophosphates. Other developments include higher xanthates and sulphur-bearing fatty compounds as collectors, higher alcohols as frothers, and hyposulphides as depressants. Caustic starch made from aqueous starch and caustic soda are used to accelerate flocculation in cyanidation operations and may have a place, also, in flotation.

Flowsheets—The trend in flotation flowsheets still is to the insertion of grinding units for the further comminution of middling products before re-flotation. The insertion of regrinding steps for middling yields not only better unlocking of the difficult grains, but at the same time it permits the use of a coarser grind prior to roughing: it connotes, therefore, a larger capacity with the same main-circuit grinding equipment. The net effect of inserting regrinding steps for middlings is, therefore, not only to improve the metallurgical work but also to increase materially the grinding capacity at the cost of a relatively unimportant new expenditure.

Thickening prior to flotation has been adopted by Utah Copper.

The trend toward the production of higher and higher-grade concentrates is everywhere in evidence. This is partly because of better chemical control of the amount and place of addition of flotation reagents, but it is also in no small measure directly traceable to better grinding. This, in part at least, is the fruit of laborious campaigns of quantitative mineragraphy.

THE BASIN-MONTANA MILL, near Basin, Mont., is treating a complex ore by flotation, making three concentrates, of lead, zinc, and iron respectively, the latter containing the bulk of the gold

Research—Fundamental research in the field of flotation continues at various places, notably in Australia, in Germany, in Russia, in Canada, and in the United States. In Australia Professor Wark and his associates continue their contact-angle researches, which have led not only to a better understanding of flotation principles but also to the discovery of a reagent of extraordinary properties and to significant contributions to physical chemistry. In Utah valuable data have been gathered on the solubilities and free energies of sulphides. This should be of direct value in guiding our understanding of the mechanism of activation. In Montana studies were continued on the flotation of minerals of near-colloidal size and evidence was adduced of the dual action of collecting agents, reactive and adsorptive. Colloid chemical results of interest were obtained in Russia and in the United States. New experiments have been initiated on the cause of attachment of bubbles to minerals. An unusually well-balanced review and contribution to the theory of flotation was presented by Professor Rey, of the University of Liége. As usual, much excellent material appears in reports of the Canadian Mines Department.

HIGHLIGHTS OF 1936 EQUIPMENT

In the Air, on the Surface and Underground, New Mechanical Improvements Aid The Mining Industry

H. C. Chellson
Assistant Editor

RESEARCH and planning on products during the dull years of depression started to bring their reward to manufacturers of mining equipment in 1936. The spread of metal-mining operations throughout the world, facilitated by airplane transport of machinery, afforded the opportunity to use improved and new mechanical devices containing new alloys and plastics. These features contributed to portability, strength, and lightness, and to lower-cost operation. Wherever the streamline design could be utilized on large or small equipment it was a stylish feature in design. A brief summary of new and improved equipment announced in 1936 of interest to the mining industry follows.

Drills—Light weight, but strong construction and fewer mechanical parts, were objectives won in drill machine design. The Ingersoll-Rand Company announced, early in the year, its SAR 120 stoper. In this machine a reciprocating motion is imparted to the rifle bar by the movement of the piston, assisted by air pressure applied alternately to the faces of the rifle-bar head which makes the rotating motion. The Gardner-Denver stopers, R-111 and R-91, weighing 123 and 94 lb. respectively, are the self-rotating type, incorporating pawl rotation and chuck cleaning by exhaust air. Each of the two types has a pushbutton on the handle so designed that the operator may hold the machine in any given position to collar a hole or drill through slips and seams. For drifting, the Chicago Pneumatic Tool Company came out with a new drilling machine made in three sizes, known as the Auto-drifter. It is an automatic-feed type which eliminates hand-cranking. The Ingersoll-Rand Company introduced the DA-35, a 150-lb. drifter utilizing the automatic feed. The company also developed the JA-30 Jackhamer, weighing only 30 lb., for use in place of heavier drills for light rock drilling, and the JA-45 Jackhamer, weighing 45 lb. The Cleveland Rock Drill Company announced its perfected sinker known as the H-11.

A hydraulic column, for supporting drilling machines, that keeps out dirt from the telescopic extension containing the piston, was designed by the Sullivan Machinery Company. Aluminum alloy makes the column light and easy to handle.

Detachable bits are finding wider acceptance among mine operators, the Ingersoll-Rand Company, makers of Jackbits, reports. Advantages of change in design and metallurgical study in tempering technique are constantly being studied. The makers of the Timken Rock bit reported an increase in depth of hardening and one of their bit types was made heavier and stronger, to perfect its use in heavier drill machines. The Sullivan Machinery Company brought out a new detachable bit with one cutting edge and the equivalent of 10 V-shaped edges for holding gage and reaming. Rip-Bits, of Sheffield, England, have developed a six-point rose bit and a reverse "Z" bit for softer rocks.

Demand for light-weight, strong, and portable core drills produced several newly designed pieces during the year. The E. J. Longyear Company announced two new core drills. One uses either gas or electric motive power and has a capacity of 600 ft. of $\frac{7}{8}$-in. core and weighs 750 lb.; the other is designed for feed oil and has a capacity of 3,000 ft. of $1\frac{1}{8}$-in. core. The Ingersoll-Rand Company offered a "Coroc" drill that registers directly in pounds the pressure of the bit against the rock. For exploratory drilling, Ingersoll-Rand brought out a light diamond drill equipped with aluminum alloy castings, making it suitable for airplane transport.

Explosives—The Atlas Powder Company introduced an improved semi-gelatin type of explosive under the name Gelodyn, which is made for blasting in wet locations. The company added to its blasting wire a longer length folder wire for electric blasting caps. Late in 1936 du Pont de Nemours developed a shunt for short-circulating electric blasting caps. It consists of a piece of aluminum foil about $2\frac{1}{2}$ in. long, wrapped around the ends of the wires covering both wires and a part of the insulation.

Haulage—To provide for a larger range in use, Atlas Car & Manufacturing Company arranged the wheels of its Type "J" training locomotives so that they may be used for any of the standard gages by moving the wheels on the axles with suitable spacing blocks. For charging batteries the General Electric Company developed a new generator known as the triple-pole generator. Three separate poles in each unit of pole structure form the basis of this design.

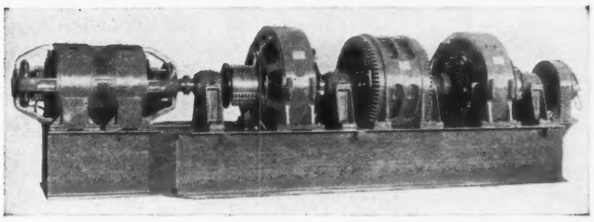
The Eimco Corporation added to its line of loaders a larger machine containing nickel-alloy steels, roller bearings, and tool-steel gears.

Hoists—In the field of portable hoists the Sullivan Machinery Company produced five types during 1936. To provide for operations in narrow working places two types of the chain-driven double-drum hoists were developed. One new type of scraper hoist for use in low working places was also developed during the year. The largest hoisting drum in the Iron Country was installed late in 1936 at a Michigan iron mine by the Allis-Chalmers Manufacturing Company. This unit is designed to hoist a net load of 17,900 lb., in skips weighing 9,200 lb., each operating in a vertical shaft being sunk 4,500 ft. deep. The diameter of the drum shaft is 22 in. Canadian Allis-Chalmers, Ltd., built a very large hoist for use at the Creighton mine of the International Nickel Company. It has two conical drums, 25 ft. in diameter at one end and tapering down to 12 ft. Embodied in this hoist are 800 tons of nickel cast iron.

Compressors—In the class of rotary air compressors Allis-Chalmers announced a two-stage sliding-vane type for gage pressures up to 100 lb. This line is developed from 20 hp. 1,740 r.p.m. to 100 hp. 690 r.p.m., for actual air deliveries of from 69 to 412 cu.ft. per minute. Stationary heavy-duty air and gas compressors of the single-stage, single-cylinder double-acting horizontal type, built in sizes from 10 to 50 hp. and from pressures from 5 to 150 lb., were announced by the Sullivan Machinery Company. This company also developed a single-gage steam-driven horizontal compressor for steam pressures of from 80 to 250 lb., air pressures up to 150 lb., and sizes 279 to 1,987 c.f.m.

Conveyors—A moving pipe line made of rubber called the Johns Conveyor was a unique materials-handling

VARIABLE MOTOR drives on bucket elevator and on two swing winches on "Natomas No. 1" gold dredge in California led to order of three more of these new units made by the General Electric Company



THE RELIANT, a multi-purpose airplane designed by Stinson Aircraft Corporation especially for the mining industry. The airplane shown above serves a Canadian gold mining company in the Porcupine district

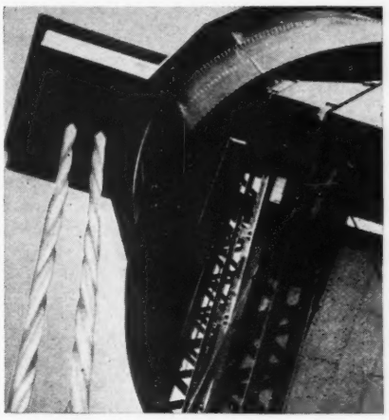
device announced during 1936. The conveyor is like an endless belt that can be set in motion and caused to make any desired turns by passing around pulleys while carrying solids or liquids. The moving pipe line is reinforced by continuous embedded chains and is split into halves throughout its length. It can be pulled apart mechanically at any point in the system to receive or discharge its load. The halves fit together by means of a double tongue and groove, preventing leakage. One of the halves is fitted with disk-like partitions, or flights, which serve to pick up a full load when passing through a feed hopper. These partitions form individual compartments, thus avoiding slipping and packing of material on vertical lifts.

A new type of truss-frame conveyor carrier was brought out by the Stephens-Adamson Manufacturing Company. It is of the three-roll in line design with rollers inclined to give the belt a 20-deg. trough. Each bearing is sealed and packed with grease sufficient to last several years. A new standardized type of conveyor built in sections for use in low headroom was also developed by the Stephens-Adamson Manufacturing Company.

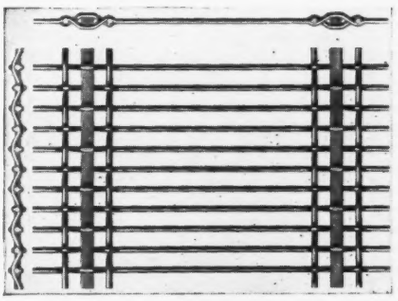
Crushing—Manufacturers of this type of equipment seek to combine simplified construction, small floor space, little headroom, and large output at low cost. Traylor Engineering & Manufacturing Company, of Allentown, Pa., introduced its Type H jaw crusher, of light weight and reinforced welded-steel frame made of heavy plates. A simple method of suspension of the swing jaw of this model is also provided.

Grinding—The Mine & Smelter Supply Company, of Denver, has been experimenting toward increased capacity and reduced power consumption on Marcy ball mills. The experiments involve a new arrangement of Marcy discharge end grates and the method of pulp discharge. Eimco Corporation reports a new double-cone head mill giving larger capacities at equivalent horsepower expenditure.

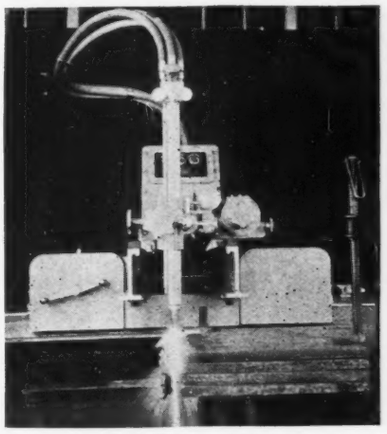
Concentration—A mechanical air-type flotation machine known as the Agitair, manufactured by The Galagher Company, had a device added consisting of a series of vertical baffles arranged radially about the impeller. This improvement features greater agitation in the lower portion of the flotation without undue disturbance in the froth of the separating portion of the flotation machine. This company also placed on the market during the year a Junior Geary reagent feeder for smaller operations. This design facilitates its use in multiple-cell units.



TWISTED PIPES made of rubber, called the Johns Conveyor, can carry solids or liquids in any direction over pulleys



THE STA-TRU type of screen, made by Ludlow-Saylor Wire Company, has uncrimpted stay bars to prevent stretching



THIS NEW OXWELD Type CM-12 shape cutting machine covers a wide range of cutting operations in a machine shop

The Weinig "Sub-A" flotation machine is said to have bettered its performance by an improved type impeller and a sensitive, accurate, pulp-level control.

Denver Equipment Company improved its side air lift agitator by its low head-drive mechanism, making installation more simplified. This agitator has a positive lifting device, raising the arms out of settled solids during a shutdown and lowering after operation is resumed. The Denver "Sub-A" (Fahrenwald) flotation machines are now made of steel, and use of molded rubber wearing parts improves maintenance. A new type impeller and hood assembly is also provided. This type of machine is said to be finding wider use in the non-metallic field.

Screens—Greater intensity of vibration resulting from applying the electro-magnetic forces equally in both directions at minimum power consumption was reported gained in the new type of apparatus manufactured by the Allis-Chalmers Manufacturing Company, under agreement with the Utah Electric Vibrator Company.

An improvement in long-mesh wire screen has been brought out by the Ludlow-Saylor Wire Company, of St. Louis, designed to give all the advantages of maximum open screen area inherent in the long-mesh type of screen, but eliminating the fault of stretching under tension. In the new STA-TRU type of screen the tensioning members of the screening equipment exert their pull exclusively on straight, uncrimped stay-bars of high tensile strength, which are woven into the screen in combination with two or more crimped spacing wires which maintain the longitudinal screening wires in their proper relationship throughout the life of the screen.

Filters—New designs and improvements in drum- and disk-type vacuum filters were announced by the Eimco Corporation. This concern's drum filters now have adjustable stroke oscillators and variable-speed motorized reducer drives, and the disk filters have unit tank construction and renewable plate valves.

Jigs—The trend of jig design has been toward the development of types suitable for use on gold dredges, and for placer mining, and for use as roughers taking the screen undersize directly or after it has passed over riffles to remove coarse gold. The California type of jig was added to others manufactured by F. N. Bendelari, of Joplin. The California type was developed for placer work and use in closed circuit with ball mill and classifier in gold mills. This type of jig has a lower feed position, and the manufacturers report that it can be used where other machinery is already installed. The Pan-American Engineering Corporation, of Berkeley, Calif., introduced a placer jig for gold concentration, activated by a new type of pulsator valve. These pulsator jigs have beds ranging in size from 12x12 in. to 42 in. square, the larger size having a capacity of 30 cu.yd. of solids per hour. The beds are covered with either $\frac{3}{8}$-in. or $\frac{1}{4}$-in. shot. The jig is a rougher type for use on gold dredges, being placed ahead of clean-up jigs.

Magnetic Separators—A tandem type induction separator with coil windings that serve twice the number of separating fields can be adapted to problems of magnetic separation where large capacities are required and maximum impurity extraction is unnecessary. Such a design of induction separator is manufactured by Stearns Magnetic Manufacturing Company.

Thickeners—Continued interest in gold mining created a demand among many operators for compact cyanide plant equipment having large capacity. The Dorr Company developed a countercurrent decantation plant in a single unit which is a space saver. Briefly, the arrangement, consisting of one five-compartment Dorr washing type thickener, does the same work as five individual thickeners used to do in a fraction of the normal space. The new unit is said to effect a saving in floor area amounting to 69 per cent; and also a power saving of 50 to 75 per cent, exclusive of grinding and agitation. Several of these plants were installed during the past year.

A feed distributor to effect a splitting of the feed sluiced to the cone portion of a feeder, into any number of products from three to ten, was introduced by the Deister Concentrator Company. This device is especially adapted for feeding concentrating tables in equal amounts. A $\frac{1}{3}$-hp. General Electric gear-head motor revolves the cone above the distributor box.

Pumps—Compact design, lighter weight, and lower power consumption continue to be features in pump manufacture. A motor-driven centrifugal pump that can be installed to operate in any position was announced by Goulds Pumps of Seneca Falls, N. Y.

A radial diaphragm pump of unique design with six pumping chambers was announced by the Logan Engineering Company, of Chicago. The chambers are arranged radially around a vertical nickel-steel drive shaft and carried on independent brackets attached to a main central housing. Each pumping chamber has attached to it an inlet valve and a discharge valve, all identical and interchangeable.

For starting motors on pumps, fans, conveyors, and compressors, the Ohio Brass Company developed its Type KAD automatic d.c. motor starter having a remote-control feature and a quick make or break switch.

Apron Feeders—For handling ore of a clayey nature, Edgar Allen & Company, Ltd., of Sheffield, England, have manufactured a heavy apron feeder designed by W. R. Degenhardt, chief mechanical engineer to the New Consolidated Gold Fields, Ltd. This feeder withstands blows from large rock falling 6 to 7 ft. from a dumping platform. It is 4 ft. wide and 40 ft. long and is operated at the Marlu Gold Mining Areas, Ltd.

An automatic dual-purpose machine for correctly and uniformly feeding material by weight, and accurately weighing, totalizing, and registering the material fed, was brought out by the Merrick Scale Manufacturing Company. The Jeffrey Manufacturing Company designed a constant-weight feeder known as the Jeffrey-Traylor. The unit consists of a vibrating feeder that is controlled electrically by a balanced weighing belt.

Dust Arrester—A new bag type dust arrester made by "Norblo" came out during 1936 and was installed at Climax, Colo., and two such arresters for installation at smelters in Idaho and Arizona will follow. The housing is made of standardized sections, and additional groups of filter bags can be provided. The bags are mechanically shaken and left in a taut position following each shaking period.

Excavators — Welded construction, greater use of alloy steels, and simplified controls contributed to the progress made in power-shovel design. The Marion Steam Shovel Company reported greater use of its 4-cu.yd. Type 4161 electric shovel in open-pit copper mining. Improvements on this model were listed as steering crawlers, inclosed gears, two vertical rotating motors, and swivel casting connection between the dipper and handle. To reduce fatigue for the shovel operator, Link-Belt Company brought out a power control with short easy-throw levers known as the "Speed-O-Matic" control. This is furnished as standard equipment on four models of the company's shovel-dragline-crane excavators. The Harnischfeger Corporation's P&H Bantam-Weight Trench Hoe replaced hand shoveling in large scale sampling operations.

During 1936 Lima Locomotive Works, Inc., announced three new excavators. One model, known as Type 405, is a combination shovel, dragline, and crane. When equipped as a shovel it has a 1-cu. yd. dipper, 19-ft. boom, and 16-ft. dipper handle. Type 1001 is a combination model and when used as a shovel carries a 2-$\frac{1}{2}$ cu.yd. dipper, 27$\frac{1}{2}$-ft. boom, and 18-ft. dipper handle. Type 1001-A is used for heavy-duty dragline only.

Dredging—Following the introductory use of a modified shovel-type variable-voltage drive on the bucket elevator and on two swing winches, the Natomas Dredging Company used this new General Electric equipment on three additional dredges. Yuba Manufacturing Company constructed a 9-cu.ft. bucket-type dredge for use under very hard digging conditions. The bucket line of this dredge, which started to operate in October, is driven by machinery ordinarily used for an 18-cu.ft. dredge.

Deterioration of rubber on power cables used on gold dredges in New Guinea was overcome by the General Cable Corporation by applying a layer of "DuPrene," a synthetic rubber that is resistant to corrosion.

Welding—Equipment and materials used in this practice are continually making progress that extends application and economy. The Dual Continuous Control in the new Shield Arc S.A.E. welder was developed by Lincoln Electric Company. This control permits the adjustment of both arc heat and arc penetration in a continuous sequence of fine increments.

Lighting—Manufacturers of electric cap lamps report a rapid rise in the use of their product by domestic and foreign mining companies. Mine Safety Appliances, of Pittsburgh, Pa., report that half of the company's Edison Electric Cap Lamps now in use were placed in service in 1936. The Koehler Manufacturing Company, of Marlboro, Mass., featured an emergency filament on the main bulb of the company's Wheat Electric Cap Lamp.

Melting Furnace—Pan-American Engineering Corporation, Ltd., with the technical assistance of Frank Short and F. W. Griffin, consulting engineers for Bulolo Gold Dredging Company, designed and constructed in 1936 a tilting electric melting furnace with full automatic heat control.

Mining Congress Elects Officers At Annual Meeting

Resolutions Passed Include Labor, Taxation, and Social Security

MEETING in annual session at the Waldorf-Astoria Hotel in New York City, on Jan. 26 and 27, the American Mining Congress transacted routine business, elected officers and directors for 1937, and passed resoluations on matters important to the welfare of the mining industry. The policies on taxation and finance approved on Jan. 15 and Oct. 1, 1936, at the Western Division meeting, were indorsed and reiterated. Salient parts of this resolution, with relation to government, are that it—

"Deal fairly with the taxpayer in the enactment and administration of tax laws. Remove from the tax laws all provisions which repress and retard business enterprise, employment of workers, and economic recovery. Amend the Federal tax laws to reestablish the flat rate of corporation tax . . . . to remove the tax on dividends received by corporations . . . . to provide full allowance of capital losses, and to permit annual declaration of value for capital stock taxes, particularly in case of mining properties in the development stage."

The resolution continued:

"We condemn the principle of a penalty tax on undistributed earnings of corporations, embraced in the 1936 Revenue Act. It retards the development of worth-while mining properties, prevents the expansion of facilities for treatment and utilization of the products of mines, and penalizes the accumulation of reserves."

With respect to definite issues the session recorded the following recommendations:

"*Labor*—The essential interest of employees and employers is to obtain efficient production through the cooperative efforts of labor, management, and capital. Any interruption of this production results ultimately to the detriment of employees, employers, and the consuming public. We therefore urge that before any strike or lockout shall be resorted to in any labor dispute, the employees who are parties to the dispute and the employers, or their duly authorized agents, should first enter into negotiations and exhaust all reasonable and lawful means of reconciling their differences.

"*Social Security*—The mining industry views with concern the economic and social hazards involved in the ultimate accrual of a huge reserve fund under the existing provisions of the Social Security Act. We heartily concur with recent official suggestions that changes in the Act in this respect might be advisable. We urge that Congress make a further study of the necessity for and the hazards in the building up of the fund now prescribed in the Act. We urge that the Bureau of Internal Revenue, in determining the wages of contract miners against which social security taxes are to be levied, apply the principle that such taxes be levied against that portion of payments made which represents wages for labor only.

"*Reciprocal Trade Agreements*—We heartily endorse the action of the State Department in connection with the treaty with Ecuador indicating that advance information will be given concerning the products to be considered for preferential treatment. We urge that any extension of the Reciprocal Tariff Act specifically provide that such advance public notice shall be given in every case, and opportunities for consultation afforded to groups affected.

"*Securities and Exchange Commission*—The mining industry considers it of utmost importance to the public welfare that explorations and new developments should be encouraged because they are vital to the continuation of the industry. They do much to provide additional employment and furnish markets for other commodities. The Securities and Exchange Commission should pass promptly upon applications for registration of mining securities. We urge the Commission to take immediate action to provide sufficient personnel to expedite the handling of registrations and to eliminate delays. We approve heartily every appropriate means of informing the public of the character of securities offered for sale, but we earnestly object to disapproval of an issue of stock for prospecting and development of mineral lands on the ground merely that such enterprises are speculative."

The following were elected to serve as directors for three years: A. E. Bendelari, president Eagle-Picher Lead Company, Cincinnati, Ohio; D. D. Moffatt, vice-president Utah Copper Company, Salt Lake City, Utah; A. B. Jessup, vice-president Jeddo-Highland Coal Company, Jeddo, Pa.; C. H. Segerstrom, president Nevada-Massachusetts Company, Sonora, Calif. For two years, to fill the unexpired term of J. B. Putnam, E. B. Greene, president of Cleveland-Cliffs Iron Company, of Cleveland, Ohio.

Officers chosen for 1937 were: President, Howard I. Young, president American Zinc, Lead & Smelting Company, St. Louis, Mo.; first vice-president, D. D. Moffatt, vice-president Utah Copper Company, Salt Lake City, Utah; second vice-president, E. B. Greene, president Cleveland-Cliffs Iron Company, of Cleveland, Ohio; third vice-president, D. A. Callahan, Wallace, Idaho; secretary, Julian D. Conover, Washington, D. C.

A.I.M.E. to Convene in New York City

▶ The 147th meeting of the American Institute of Mining and Metallurgical Engineers will be held from Feb. 15 to 18 in New York City. The technical program will include talks on the use of the airplane in the mining industry; a unique occasion devoted to discussion on mineral industry education; mineral economics; health and safety in mines; mining and milling methods; non-ferrous metallurgy; mining geology and geophysical prospecting. A session will be devoted to iron and steel; a symposium on the problems of acid waters from coal mines and the petroleum division will discuss special engineering problems and statistics of the industry.

The entertainment will include a dinner-smoker on Feb. 15. The annual reception and dinner will be held Feb. 17 at the Waldorf-Astoria Hotel. President J. M. Lovejoy will preside as toastmaster, the William Lawrence Saunders Medal will be presented to Erskine Ramsay and the Anthony F. Lucas Medal to J. Edgar Pew.

California

Mother Lode to Have a Large Mill

Prospecting during past year on property south of Jamestown determines existence of commercial low-grade deposit

▶ A 1,000-ton mill, to be completed by early spring, is under construction on the extensive holdings of the Calaveras Land Company south of Jamestown. The properties acquired by the company embrace more than a mile of Mother Lode hanging wall and include the Ida Klein mine and lands owned by L. M. McRae, O'Donnell, and Kelly, and the Smith Ditch & Mining Company. Extensive diamond drilling conducted for the past year has proved the existence of commercial low-grade ore averaging 150 ft. in width, which will be mined by open-pit methods, with tractor-operated scrapers and bulldozers. The mill will contain primary and secondary crushing units, a ball mill and classifier, and amalgamation equipment for recovery of gold values. J. S. Cademortari is general superintendent.

▶ With preliminary work completed, Oro Fino Consolidated Mines has started underground development at the Oro Fino mine, near Auburn. The company has recently completed the installation of a new headframe, hoisting equipment, electric substation, and power lines, and work on the 300-ton mill is progressing satisfactorily. J. C. Kemp van Ee, San Francisco, is general manager of the company.

▶ Operator Consolidated Mining Company has added two additional batteries of five stamps each to its milling plant near Johannesburg, bringing the plant total up to 15 stamps. Motive power for the new crushing equipment is furnished by a motor installed recently. George Silveria, superintendent, is in charge of operations.

▶ With about 4,800 ft. of old workings rehabilitated and more than 1,000 ft. of new development completed, Boston California Mining Company plans early erection of a 100-ton mill at the Malvina mine, near Coulterville, to treat the substantial tonnage of ore developed during the past year. Operations are directed by E. McMahon, superintendent.

▶ Cardinal Gold Mining Company is completing plans for extensive development of properties adjoining its mine near Bishop, Inyo County, acquired about a year ago. Recent enlargement of the mill and installation of larger pumping equipment make possible the opening of several of the 34 claims owned by the company. The mill is now treating more than 250 tons of ore. Victor Bongard is general manager of the company.

▶ The Alhambra and Shumway mines, near Kelsey, are reported to have been taken under lease and option by a group of Southern California oil men, including C. E. Haliburton and B. Williams, of Los Angeles. Construction of surface plant buildings and power lines is in progress, and a 50-ton mill is to be erected later.

▶ Early erection of a plant for refining barium ores on a 55-acre site purchased recently at Rosamond, in Kern County, is contemplated by the Western Barium Corporation. Ores mined from the company's deposit in Nine Mile Canyon, near Linnie, are trucked to the site and stockpiled, pending completion of the refinery. Construction of the project will provide work for about 50 men. R. A. Fredericks, Russ Building, San Francisco, is president of the company.

▶ Vera Mines Corporation, controlled by Santa Barbara interests, has concluded negotiations for a 125-ton flotation plant which is to be placed in operation at an early date at the Uncle Sam mine, near Kennett, Shasta County. Mining equipment received recently at the property includes a compressor, an Eimco loader, an electric locomotive, ore cars, and rail supplies. A. A. Wren is in charge of operations.

▶ The Mistletoe mine, in the Rough and Ready district west of Grass Valley, is reported to have been acquired by Assemblyman F. P. Glick, of Los Angeles, owner of the Welded Products Company, Ltd. At present a headframe and other surface structures are being erected preparatory to operation of the property, with R. Roberts, one of the original owners, in charge of the work.

▶ Dayton Consolidated Mining Company, controlling the Davey, Clark, and Davenport properties, in Garden Valley, has started diamond drilling after a brief shutdown. The work is carried on from a station cut recently on the 200-ft. level and holes will be drilled to a depth of 900 ft. If results merit further exploration, holes will be drilled in other sections of the mine in an attempt to determine orebodies, faults, and the general geology of the section. H. A. Weiler is in charge of operations.

Colorado

Non-Metallic Production Increasing

Producers of feldspar, gypsum, and vermiculite help supply the demand in the building industry

▶ The quarries and mines of Fremont County produced 10,000 tons of gypsum, 30,000 tons of feldspar, over 150,000 tons of limestone, and many tons of fireclay, mica, and granite during 1936. The Colorado Vermiculite Company, Inc., has a plant where vermiculite is roasted, sacked, and marketed. Recent shipments in carload lots have been made to St. Louis and New York. Vermiculite is mined in Custer County, at the Sparling Ranch, and from a large deposit found recently near Grape Creek. It is estimated that vermiculite mined during 1936 in Custer County will amount to 2,000 tons.

▶ A small cyanide plant is being built near Silver Cliff, in Custer County, by Stroehlke and Henning, to treat the Bassick mill tailings dump, on which they have a lease.

▶ Fluorspar operators in Chaffee County are shipping large tonnages of spar to various parts of the country, and the Colorado Fuel & Iron Company is shipping about 1,200 tons of lime rock daily to its plant at Pueblo. The granite quarries have greatly increased their production of stone over that of the past several years.

▶ United States Vanadium Corporation completed during the last year a 100-ton mill for the treatment of carnotite ores containing vanadium, uranium, and small amounts of radium. The company also completed building the modern town of Uravan, in Montrose County, which will house a population of 350 and includes a large administration building, hospital, hotel, post-office, store building, and a school. It owns its own water system and electric power plant. The mill is now treating 60 tons of ore daily.

Nevada

Blizzards Check Many Operations

Cold weather freezes water lines in mills —Mountain City Copper prepares to step up mill capacity—Development on 1,200 at Tybo

▶ Storms, deep snow, and intense cold greatly hampered mining and milling operations throughout Nevada during the most part of January. Production was far below normal and numbers of remote mining camps suffered from shortage of supplies. Nearly all roads were blocked for weeks, even in the southern part of the State and at lower elevations where snow is rare. Sub-zero temperatures, reaching 43 degrees below zero in the northern areas, caused nearly all mills to suspend, some only for a few days, however.

▶ Development work is being extended on the newly opened 1,200-ft. level of the Tybo lead-zinc-silver mine of the Treadwell Yukon Company, Ltd., 60 miles northeast of Tonopah, in Nye County. The 500-ton flotation mill was closed down during the autumn and will resume crushing ore, probably on a 200-ton daily basis, early in February, according to W. H. Blackburn, manager. Pumps are handling around 1,200 g.p.m. from the bottom level.

▶ In the Awakening district, in Humboldt County, the lately completed 25-ton amalgamating and concentrating mill at the Austins' Jumbo mine, which gained wide publicity last year, was closed down when cold weather made necessary the draining of the 2-mile pipe line from a well in the valley. Deep snow impeded other work in the district.

▶ An agreement reached lately between State officials and the O. A. Smith Corporation, of Milwaukee, operating the Round Mountain mines of the Nevada

Porphyry Gold Company under option of purchase, was believed to insure early construction of a power-line extension from the Pioche terminal of the Boulder Dam line to Round Mountain, involving a cost of some $30,000. Approval of the Round Mountain extension is contingent upon the construction at that point of a large-capacity mill. The Smith Corporation has provided a 100-ton test mill for treating samples.

▶ Additional equipment provided by the Mountain City Copper Company will increase from 300 tons to 400 tons per day the capacity of its lately completed flotation mill at Mountain City, in northern Elko County. Prior to and since completion of the mill, in October, the company has been trucking 50 to 100 tons per day of high-grade copper ore to Mountain Home, Idaho, for rail shipment to the International smelter near Tooele, Utah, but deep snow lately closed the road. The main shaft is being sunk from the 800-ft. level to a depth of 1,000 ft.

▶ The 250-ton flotation mill of the Weepah-Nevada Mining Company, in Esmeralda County, was shut down for a few days due to frozen water pipes. The new cyanide unit is nearly completed and it is said that within a short time cyanidation may completely replace flotation, effecting a higher metal recovery and eliminating heavy marketing costs. E. J. Schrader is consulting engineer and J. C. Perkins superintendent.

▶ Sale of formerly productive gold-silver properties of the Majuba-Fresno Silver Mining Company in the Antelope district, in Pershing County, for $75,000, on time payments, is reported. The purchaser is H. R. Fisher, president of and acting for the Nevada Metals Mines Company, which has been active at Hamilton, in the White Pine district. The mine, formerly known as the Last Chance, is opened by a shaft and tunnels and has produced ore of smelting grade.

▶ Two old mines, the Fravel-Paymaster and Golden Fleece, on Peavine Mountain within 10 miles north of Reno, have been producing ore of high grade for shipment to the International smelter in Utah. The Fravel-Paymaster is worked under lease by Tony Romano, of Reno, and the Golden Fleece has been leased to Palma and Burns, also of Reno. An ore-loading ramp has been provided at near-by Panther siding on the Western Pacific Railroad.

▶ Nevada-Massachusetts Company, foremost American tungsten producer, has completed a 100-ton addition to its 250-ton flotation mill near Mill City. The auxiliary plant is designed to treat slime from the main mill. Sinking has been resumed at the 1,050-ft. level of the Stank shaft. The company's Silver Dyke mill, in Mineral County, was closed for some time by cold weather. Ott F. Heiser is manager.

▶ Simmerone gold mine is reported acquired by the Eastern Exploration Company, subsidiary of Calumet & Hecla Consolidated. The old workings are said to contain a fair grade of milling ore and new sections of the mine are being prospected. The Tom Rea copper property, near Jackson Mountain, 13 miles south of Goldfield, is also said to have been acquired.

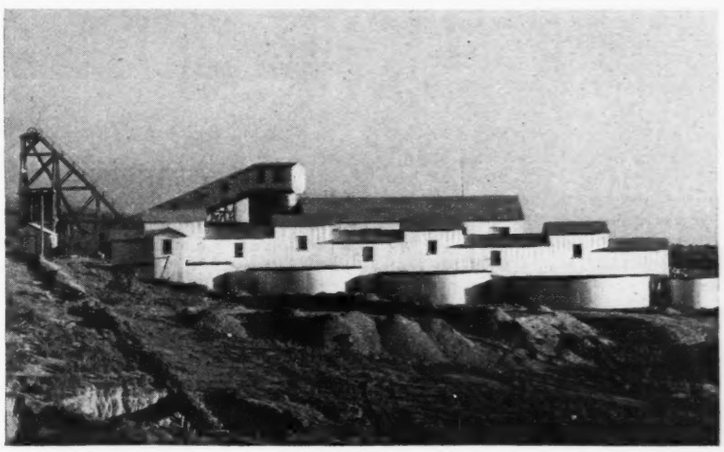
▶ Preparations for large-scale development of properties of the Consolidated Coppermines Corporation at Kimberly, in the Robinson or Ely district, White Pine County, were indicated lately by the arrival of heavy-duty mine equipment. Crews of men were engaged until late in the year laying pipe lines to the property from water sources owned by the company. J. B. Haffner is manager, with offices at Kimberly.

▶ Plans to reopen the old Centennial gold mine, 15 miles southwest of Mountain City, in Elko County, are announced by a group of Utah men. The mine, at one time a producer of rich ore, was abandoned over 30 years ago.

▶ The Lakeside Monarch Mining Company recently struck a well producing 300 gals. of water a minute. This development will assure the mill being projected an ample supply of water for operations, since, it is estimated, only 100 gals. a minute is necessary. The water will be pumped 2 miles to the site of the proposed mill.

▶ Silver-lead carbonate has been opened up in the raise from the 750-ft. level of the King David Mine, Frisco, in Beaver County. Gangue minerals are quartz, iron, and manganese. Numerous similarities in the formation are being noted when conditions in the adjoining Horn Silver mine are compared. The company has installed a new cable for the hoist.

▶ Utah mining leaders are planning for the Western Division Convention of the American Mining Congress to be held Sept. 6 to 11, in Salt Lake City. O. N. Friendly, chairman of the Western Division, recently appointed these men chairmen of committees: W. J. O'Connor, arrangements; E. A. Hamilton, dinner; James Ivers, entertainment; J. D. Shilling, exposition; G. W. Snyder, publicity; W. Mont Ferry, toastmaster; J. O. Elton, tours; J. W. Wade, welcoming.



New cyanide plant for the treatment of ores from the West Dip Mine, in the Mercur district, Utah. It is of the all-sliming, countercurrent decantation type having a capacity of 150 tons of ore daily.

Utah

Mine Operations Normal Following Strike

Park City Consolidated prepares development from the 1,050-ft. level—Drainage and transportation tunnel discussed in Tooele district

▶ Settlement of the miners' strike in the Park City district was followed by a prompt return to normal activity and production. All of the district's leading producers are shipping steadily to Salt Lake valley smelters.

▶ Talk about a deep tunnel for the Bingham producer and others is revived. Several tunnel projects have been discussed, one from the Tooele side and the other from the Bingham side, but, desirable as such a project seems, none have advanced from the problematical stage, particularly as to financing.

▶ Considerable speculative interest has been focused on the Utah Apex mine, in the Bingham district, as the result of definite negotiations being carried on by the Utah Delaware Mining Company. Report has it that a program of development for the old producer is being discussed, with the possibility of the International Smelting Company taking the lead.

▶ New developments at the Park City Consolidated Mining Company mine have intensified interest in the East Side property. Deepening of the main shaft to the 1,400 level promises to open up important stoping territory. A station is being cut on the 1,050 level, preparatory to drifting into the ore on this horizon.

Idaho

Star Mill at Burke Takes Shape

Completion expected in Spring — Shaft sinking proposed at Mineral Mountain — Deeper drilling at King Solomon

▶ Construction by the Hecla Mining Company of the company's Star mill, in Burke, is progressing rapidly, the program being maintained according to schedule. The mill will treat lead-zinc ores and will be one of the largest in the Northwest, having capacity of treating 750 tons of ore per day. The mill was designed by W. L. Zeigler, metallurgical engineer for Hecla, and construction is in charge of E. L. Woods, superintendent.

▶ A raise on ore encountered in a crosscut at the Liberal King, in the Pine Creek district, is under way, and a favorable showing of lead-silver ore is reported.

▶ Plans for shaft sinking at the Mineral Mountain property, in Spring Gulch between Kellogg and Wallace, are now being considered by the management. Ore on the tunnel level is reported to show good assays in silver. The management states production will start as soon as shaft sinking permits development in depth. Fred Theil, of Wallace, is president of the company.

▶ Supplies to last the Mammoth mining crews, operating 12 miles from Dixie, in Central Idaho, six months, were sent in recently by the Bunker Hill & Sullivan company. The Mammoth mine has ten unpatented claims opened by five tunnels, one 400 ft. long. R. S. Erb, of Lewiston, is president and R. G. Bailey is secretary of the company. The Bunker Hill & Sullivan took an option and lease on the property 14 months ago and for more than a year has employed ten men in development work.

▶ The Aurora Mining Company, operating in the Deer Creek district of the Coeur d'Alenes, recently added ten claims to its former 30. The company is driving a 750 ft. crosscut to a vein of silver-lead ore found on the 800-ft. tunnel 250 ft. above. It is expected that the orebody will be contacted by the end of February. C. E. Biggs, of Wallace, is president of the corporation. The Washington offices of the company are at 701-2, Spokane and Eastern Trust building, Spokane.

▶ A pot reported to weigh 20 tons with a capacity of 235 tons of molten metal, said to be the largest of its kind ever built, is en route to the Bunker Hill smelter, at Kellogg, from Chicago. The huge kettle was placed on board a gondola, and in order to balance the load it was necessary to place 12 tons of ballast in the bottom of the car. The pot is 16½ feet in diameter and is the first of six which the Ferguson & Lang Foundries, Inc., is building for the Bunker Hill company.

▶ Diamond drill results at the property of the King Solomon property, in the Fourth of July Canyon district, have disclosed a vein 10 ft. wide at a depth of 150 ft. below the surface, according to Jean Peters, geologist. On the surface the vein shows a width of 4 ft., containing quartz with silver, lead, and gold. Additional diamond drill holes will be made to prospect the vein at the 500-ft. horizon.

▶ Located in a well-defined mineralized zone in the Little North Fork River area, northwest of Cataldo, the Crystal Spring Mining Company is planning a development program, according to L. G. Evans, president. Mr. Evans has spent many years in that region, prospecting a ledge reported by engineers to be 120 ft. in width and intersected by a number of smaller veins from 4 to 10 ft. wide. The company owns a group of four claims, covering the vein for a distance of 3,000 ft. President Evans states plans are now under way to finance the project.

Arizona

Companies Press Shaft Sinking Programs

Greater production likely this year as development expands — Inspiration Consolidated producing 15,000 tons ore daily

▶ The Nellie Meda Gold Mines, of Aguila, Maricopa County, 25 miles west of Wickenberg on United States Highway 60, is planning to sink the company shaft to the 250-ft. level. Orebodies have been developed in the upper levels and they are expected to continue in depth. If they are found, the company plans to resume milling operations. Ned Creighton, of Phoenix, is president of the company.

▶ The old Moss mine, 3 miles from Oatman, in Mohave County, recently optioned to George Holmes and associates, of Los Angeles, Calif., is being actively prospected. Mr. Holmes reports that he expects to deepen the shaft from the 200-ft. level to 800 ft. This property was discovered in the early 60's and produced high-grade gold ore which was shipped by water and rail to San Francisco.

▶ The Tally and Wall property, in South Mineral Hill, near Superior, is producing 350 tons of silver ore monthly. The shaft is being deepened and production is expected to be increased. Ollie Wall is mine superintendent. Seven men are employed.

▶ The Tungsten Reef Mines Company, at Hereford, in Cochise County, is milling 300 tons monthly producing a concentrate high in tungsten. J. J. Seeman is superintendent at the mine. Eight men are employed.

▶ American Smelting & Refining Company is producing in excess of 2,000 tons of gold ore monthly from its Octave property, east of Congress Junction. About 91 men are employed and the mine is working two shifts. The smelting company is working under a profit-sharing agreement with the Arizona Eastern Gold Mines Company. M. E. Pratt, of Octave, is superintendent.

▶ The Arizona Molybdenum Corporation, at Copper Creek, in Pinal County, is producing about 8,500 tons of molybdenum and copper ores monthly. H. Hendricks is general manager.

▶ J. B. Goodwin, mine superintendent for the Keystone, Inc., at Mineral Park, has taken over the Alpha and the Andy Goodwell estate properties, in Stockton Hill. A road has been built over the mountain to facilitate hauling ore to the mill of the Keystone company at Mineral Park. Ores from the Jameson mine and the Champion mine, situated south of Mineral Park, in the Cerbat range, are also being hauled to the Keystone mill. The mill has a daily capacity of 50 tons. Lester L. Robinson, 315 West Fifth St., Los Angeles, is president of the company.

▶ M. C. Richardson, Earl F. Hastings, and W. A. Walls, associated with I. A. Essenwein, of St. Louis, Mo., and George Waller, of Chicago, have closed negotiations on the Rainbow properties, near the Samoa mine, east of Chloride. A new road is being built to the property. Several thousand tons of gold-silver ore in the dumps and stopes will be hauled and shipped as quickly as the road is completed. Mr. Essenwein will be in charge of operations.

▶ The new 125-ton mill at the Vivian mine, 3 miles west of Oatman, is being constructed and is expected to be ready for production about the middle of February. The old Leland mine is being opened on three levels and the Oro Fino on two levels. Arthur E. Dirrum is superintendent, assisted by Walter Reid, of Reno, Nev., engineer, and Del Sanderson, mine foreman. Thomas Barton is president and A. E. Kearns, secretary. The company operate the Consolidated Chollar mine, at Grass Valley, Calif. Its offices are in San Francisco.

▶ The Inspiration Consolidated Copper Company, at Inspiration, is producing about 15,000 tons of ore daily. Copper from oxide and sulphide ore is recovered in a leaching plant and the slimes are sent to the concentrator. The company's pay-roll has about 1,500 men at present, having increased gradually during the past year. Thomas H. O'Brien is general manager; Frank A. Wardlaw, general superintendent; Joseph L. Johnson, mine superintendent; and Harold S. Aldrich, leaching plant superintendent.

▶ Oklahoma group of mines, 14 miles northeast of Florence, in Pinal County, is maintaining a production of about 300 tons daily. The ore contains gold, silver, lead, and copper. The property was recently acquired by W. D. Roberts, of Santa Ana, Calif. W. D. Cochran, general superintendent, reports the mill tests have been satisfactory.

▶ The Cooke-Kehoe-Beale State lease of 120 acres in the Lonesome Valley gold field near Jerome has started shipping ore to the United Verde Extension smelter. The ore is said to contain 2 oz. of gold per ton. Clarence J. Beale and W. E. Kehoe, active in the lease, are employment agent and chief electrician, respectively, of the U. V. X.

NEWS FROM Washington

By Special Correspondent

MESSAGES from President Roosevelt will present to Congress one by one the wanted legislative enactments. The three major messages of January—at the opening of Congress, budget, inaugural—were general in significance and did not present the agenda of the session.

As a matter of fact, there is probably not available anywhere a list of wanted or "must" bills. The President will decide many pertinent questions during the coming months and formulate the specific steps of his program as conditions of the late winter and spring may dictate. Then his requests for legislative authority or other enactment will be forthcoming.

Money Controls

EVEN sharp critics of the Administration did not offer any real objection to the extension of the President's authority for fixing the gold value of the dollar nor to his use of the $2,000,000,000 "stabilization fund." In the Senate one might well have expected Glass, Byrd, and Vandenberg to object. Vandenberg did make a gesture of asking for a public accounting for the stabilization fund at the end of the extended period; but he did not press this vigorously. Byrd, pressing his Economy plans, sought to limit the extension to one year; but he did not fight vigorously against the extension through June, 1939, which was voted. Glass was silent.

From this situation it is evident to every industry executive that in international matters and matters affecting money war, as well as military wars, the President will lead with almost unanimous Congressional support. For the mining industry it is important to recognize this situation, especially when considering trade, tariff, neutrality, munition control, and other commodity subjects of mineral-industry importance.

Tariff Methods

BILATERAL trade agreements will be negotiated by the State Department under Presidential supervision for another three years. This prophecy assumes that Congress will give legislative approval to the request for a three-year extension of the Act first passed in 1934, granting this special tariff-making authority to the Executive. But this forecast involves no measure of uncertainty, even though it is made barely two days after the President's request is announced. Congress may not like all features of the trade-agreement plan, but it will not clip Secretary Hull's tariff wings.

A new technique of negotiation is promised. The State Department has already, proceeding on this plan, announced that it contemplates negotiations with Ecuador. Thus it invites comments on trade with that nation. And it promises that when proceedings have advanced a bit further there will be given out for all interested persons a list of the commodities on which negotiations are actually proceeding. At that stage, any unit of industry directly concerned may make such representations as seem needful. This is hardly a "gold-fish bowl" procedure. But it does depart radically from the former plan, which had all negotiations conducted in the greatest of secrecy. The change in method will perhaps produce little change in actual results, so far as rates of duty are concerned; but it will probably satisfy that group of critics who made the only important impression when they charged "star-chamber" methods.

SILVER

SILVER-STATE senators are apparently "persuaded" that they will do well merely to hold the present fortress which insures domestic producers a special bonus on virgin silver. Those who really know legislative trends state without hesitation that this Western group will no longer argue for additional silver buying in order to build up the metallic reserve ratio, as once demanded. They are said to be convinced by the course of recent events that it was not possible to control the world silver price, as they sought.

THE MINING industry should not interpret this decline in silver activities as a loss of influence on the part of so important a group of senators. Whenever there are problems of common concern to the West the group will coalesce promptly and exert its customary influence. Nor is there any reason to doubt that newly mined silver will continue to receive for some time the present mint payment of 77.57c. an ounce.

Budget "Balance"

TAXES will increase in order to carry the budget closer to balance. Little or no evidence is to be found in Washington of effective economy. Even governmental reorganization is now admitted by the President to be a matter of "efficiency." Industries which have thought that with the end of emergency-depression conditions there would be a decline in federal tax burdens will be completely disappointed in their expectation.

The budget message of the President indicated an expected income of record proportions. Legislation in the present session of Congress will *not* do anything to curtail the taxes on which such income estimate was based. Even the minor "nuisance" taxes will be continued, except possibly two or three little ones which cost more to collect than the return to the Treasury justifies. The Administration makes no pretense that it seeks to lighten tax burdens, especially those which bear on riches, commodities, and industry.

As yet there is no important discussion in Washington about *increased* tax rates, if that can be regarded as of any comfort to business men.

Wages and Hours

UNCLE SAM may constitutionally forbid movement of prison-made goods into a State which has itself undertaken to embargo such commodity. This broadly paraphrases the Supreme Court decision of January. Then labor legislation advocates ask, "Why not goods made by child labor?" Or, "Why not goods made under hour-and-wage conditions obnoxious under a State law?"

A flock of bills undertaking to provide a firm basis for joint action of the Federal and State governments are now in Congress. They are based in part on this simple theory. In part they rest on the other recent Supreme Court finding, which authorized states to accord a manufacturer the right to control resale prices of his trademarked goods. The latter decision, of extreme importance as determining merchandising practice, is believed also to strengthen the hands of those who seek Federal means for labor benefits.

Certainly some bills based on these two theories will be enacted. Any executive must, therefore, expect continued new Federal pressure for higher wages and fewer hours, even though no reincarnation of a Blue Eagle occur. The latter is not expected. A different kind of a bird—or maybe a beast—is much more likely. But it is too soon to guess what animal the rapid evolutionary processes of Washington will develop this year.

Neutrality

THE PRESIDENT may be given abundant authority by Congress to restrict international movement of goods which threaten the neutrality of this nation. This is a clear implication of the Supreme Court finding regarding the President's embargo on movement of material sought by belligerents in the Chaco. This decision, unimportant in itself, becomes tremendously significant as a guide to further protection of neutrality.

Congress will take full advantage of this decision. In a sense it did so as the first legislative enactment of the session which authorized the President to restrict goods movement to Spain "during the existence of the state of civil strife." As the session develops, more comprehensive enactments of this sort are expected. It is not clear how much they may ultimately affect movement of

important raw materials—copper, for example. It seems evident, however, that the general public and Congress are in a more vigorously restrictive frame of mind than is the President himself.

Navy Copper

AS PREVIOUSLY forecast by *E.&M.J.*, the Navy did negotiate copper purchases for pressing current needs. But the problem of buying within the restrictions of the Walsh-Healy law has not been solved, not even for this metal. Congress will soon be asked to tighten up on some features of the law, in order to force compliance with labor standards by means of Government purchase restrictions. Opposing this are all important Government purchasing units. For it are all labor reformers. The issue is clear, but the outcome is in doubt.

Mineral Land Claims

UNDER the mining laws a claim may be taken up and all of the minerals therein mined and disposed of without notice to the Department of the Interior. Only when an application for a patent is made is the claim recorded in the United States Land Office, and then, if discovery has been made, title to the land passes from the United States on payment of a nominal fee. Commenting on this, Secretary Ickes recently said:

"Particularly now that most of the land of the public domain is dedicated to some public purpose or is under some system of administration, is such a method of handling mining claims unbusinesslike and contrary to the public interest. Some simple system of permitting the discovery and development of minerals under a prospecting permit and lease subject to supervision that would protect the public interest without hampering the operations of the permittee or lessee would mean a forward step in mineral-land administration. Minerals still on Indian lands are subject only to a lease under a system that works well. Its extension to the reservations of the public domain is recommended."

Strike Issues

PERHAPS no other labor controversy of the past decade has so sharply focussed Washington's attention on the fundamental issues as has the General Motors case. A clarification of these problems may prove to be one of the most important results of this labor disturbance. Outstanding questions in the controversy which may be partly settled, but of course not finally determined, are:

1. Is a "sit-down" strike a legitimate form of picketing? Its effectiveness as a method gives it great appeal for labor leaders. A much smaller number of affected persons can control a situation by this means than by any other. But critics argue that ownership of property ceases to be real if a small number of employees may legally "trespass" in this fashion and destroy control by the owner and prevent decision by management as to whether to run or to shut down.

2. How large a percentage of employees is required to determine the rights of a union to negotiate? This issue is clean cut in some of the motor controversy where admittedly a minority demands the right of sole negotiation for non-members as well as members of their unit.

3. Establishment of the closed shop. In the motor industry this would be but a step toward complete unionization of great sections of industry, probably including much of mining and metal working not now even partly so organized. Labor executives are hopeful one way and management leaders the other. Perhaps no other single case in labor history has the important precedent-making significance of this one.

4. The principle of seniority for employees is at stake. Operating executives generally argue that this destroys the effectiveness of management and that it would increase manufacturing costs generally by substantial percentages. Acceptance of this principle is likely to be as bitterly contested as is the closed-shop issue. Even a partial victory for labor on this point would be precedent making, Washington clearly understands.

Whatever the outcome of General Motors troubles or of other labor controversies, it seems clear that labor costs on many, if not most, industrial products are due to increase during 1937, regardless of the skill of managements.

DUTIES TO BE CUT

THE ATTITUDE of Secretary Hull regarding further negotiations is evidenced clearly by his statement before the House committee considering the resolution for extension of this work. At that time he characterized prevailing tariff rates as "exorbitant." He frankly stated that many cuts were to be made in the Smoot-Hawley duties. The major uncertainty of importance to the mining and metal industries is, therefore, whether the special levy on imported copper will be continued after June. Prophecy on that point is futile.

ONE OF THE LATEST developments in trade-agreement policy is the suggestion that the President now intends to ask the Senate to confirm all of the bilateral trade acts which have been negotiated and signed. Such request would undoubtedly be granted by the Senate, though there would be something of a battle over certain commodities or treaties. The purpose of such action is, of course, fully to legalize these new tariff enactments by eliminating the criticism, occasionally heard, that such actions are both legislative and treaty-making in nature. As such, critics say, they require Congressional approval to be fully effective. The Administration does not regard such criticism as valid, but as a precautionary measure probably will ask legislative "OK."

Labor "Deal"

JOHN L. LEWIS has demanded of President Roosevelt that he pay off labor in return for its political support of last fall. Washington believes that no more brazen demand on the White House has been made in recent years. The influence of such claim for support from the Chief Executive, as a return for the votes delivered in November, does not promise to be helpful to the cause of labor. Even those disposed to favor unionization by C.I.O. technique do not like to make the official referee into a combatant.

Uncle Sam's Aluminum

NEW aluminum production in the United States during 1936 increased 89 per cent over that of the preceding year and came close to the record high in output of 229,037,000 lb. established in 1930. According to the United States Bureau of Mines, production in 1936 was 224,939,000 lb., valued at $41,412,000, against 119,295,000 lb., valued at $22,070,000, in 1935.

The principal producing plant was that at Massena, N. Y., where approximately 41 per cent of the metal made in the United States in 1936 was produced. The works at Alcoa, Tenn., accounted for 30 per cent of the output, and the plants at Badin, N. C., and Niagara Falls, N. Y., contributed the remaining 29 per cent.

The increase in domestic production of aluminum in 1936 reflected a sharp rise in domestic consumption of this metal. The general improvement in industrial activity increased the demand for aluminum in the well-established uses, and, in addition, several new uses were developed.

The first aluminum dredge boom, the longest in any metal, was placed in service during 1936. Its total length is 240 ft. Aluminum was used more extensively for bridge floors, bridge railings, pilot houses, truck bodies, and buses.

Brewers are now using aluminum tanks for fermentation and storage, the Bureau's summary points out. Aluminum beer barrels are said to be making gains. Consumption of aluminum paint as a protective coating has doubled since 1929. New uses for aluminum include lighting reflectors, license plates, and home and office windows. Its use in the arts has increased.

Foreign trade in unmanufactured aluminum in 1936 showed a substantial increase in imports and a sharp decline in exports. Imports of ingots, scrap, and alloys rose from 21,075,683 lb. in 1935 to 25,158,541 lb. in 1936, whereas exports declined from 3,361,097 to 953,546 lb. Imports of sheets, tubes, utensils, and other manufactured products increased in value from $633,310 in 1935 to $1,200,385 in 1936; exports declined slightly from $1,581,290 to $1,479,520. Data on imports and exports were obtained from the Washington Bureau of Foreign and Domestic Commerce.

Montana

Mills Operating From Stockpiles

Winter weather holds up ore shipments and ore accumulated during summer is used—Higher metal price brings wage increase to workers of Anaconda Copper

▶ The recent improvement in the price of copper is reflected by improved Montana labor conditions. The payment schedule in force in all the units of the Anaconda Copper Mining Company is based on 10c. copper, with a bonus adjustment in terms of each rise of 1½c. a pound. The bonus becomes effective after the average price has held at the bonus increment for a period of 30 days. Thus, miners at Butte, on a day's pay basis starting at $5.25 a day rate, are now assured of a $5.50 rate, with good prospects that the rate in accordance with 13c. copper may soon equal $5.75 a day. It is also understood that all rates of pay, including the monthly roll, are adjustable on an equivalent basis. The benefits of this schedule should be particularly noticeable in Butte, Anaconda, and Great Falls.

▶ Mining activities throughout the State are being subjected to the difficulties accompanying severe winter conditions. In several instances shipping schedules from the better-established properties are maintained with difficulty. To cope with these winter conditions some operators stockpile ore in the summer in excess of mill requirements. Stockpiles are drawn upon in winter when production is reduced. Typical among these is the operation of the McLaren mine, at Cooke City. This property is strictly a gold producer and the concentration is accomplished by combined flotation and cyanidation in a plant situated at Cooke, about 4 miles from the mine. During the summer months excess tonnage of ore is trucked to the mill and stocked. Production is derived from surface workings; therefore, almost all production is terminated in winter. The property is managed by Walter McLaren. An extensive exploratory program has been necessary because of the unusual characteristics of the complex ore occurrence. The plan of exploration has included both deep surface trenching by deisel-powered bulldozers and by churn drilling. Ore mined to date is from exploration only, as there has been no direct attempt to set up mining operations in any particular locality. Similarly, the treatment has been experimental and the present 75- to 100-ton plant is primarily of a pilot nature subject to frequent readjustments. The McLaren mine is considered one of the outstanding mine developments in the State. It is estimated that the ore resource is extensive, and in the near future a large operation is anticipated at this property.

▶ With the opening of the Montana State Legislature the question of licensing engineers of the State will probably be brought up for reconsideration. At present, Montana is one of only ten states in which laws governing engineering practice are not in force. Dr. L. D. Conkling, of the Montana State College, at Bozeman, and several of the professional societies, including the Montana Society of Engineers, are studying the problem in the hope that a useful form of licensing may be determined. Engineers in Montana are aware of the need of regulation, but they are not willing to indorse any superficial plan which is clearly not adapted to improve the situation, and to date no plan has been proposed which appears sufficiently comprehensive to be acceptable. They feel, however, that in these days of far-reaching individual regulation, the passage of some law in this regard is inevitable.

Raised digging ladder of 7½ cu.ft. dredge removing overburdened on the gold placer operated by the Rouge River Gold Mining Company on Graves Creek about 20 miles from Grants Pass, Oregon. Gold output from Oregon in 1936 was approximately 59,900 oz.

Michigan

Hussey & Co. Merges Into Copper Range

Joining of fabricator and copper producer approved by stockholders—Quincy expects to start operations April 1

▶ Merger of C. G. Hussey & Company, a Pennsylvania corporation, into the Copper Range company, a Michigan corporation, has been approved by the stockholders of Copper Range. All shares of common stock of C. G. Hussey & Company, other than those owned by Copper Range, will be converted into shares of common stock of the Copper Range company, on the basis of two and one-half shares of Copper Range for each share of C. G. Hussey & Company. The shares of common stock of the Hussey company held by the Copper Range company will be canceled, and the capital stock of the Copper Range company increased from 550,000 shares of common stock without par value to 565,000 without par value. For several years, Copper Range has held the controlling interest in C. G. Hussey & Company, which is engaged in the fabrication of copper products, with plants at Pittsburgh, Pa. Copper Range is pushing development work at the Globe property. The shaft is being deepened to facilitate crosscutting to the 18th level drift from the Champion mine, and drifting is proceeding in the 9th level. The vein is said to be wide and well mineralized.

▶ Quincy Mining Company, now employing 125 men, is engaged in pumping operations at No. 6 shaft and making mine, mill, and railroad repairs. It is planned to start production about April 1.

▶ Although Isle Royale stock has had a considerable rise in the last few weeks, no steps have yet been taken to reopen the property, which has been idle for several years. Isle Royale is under the management of Calumet & Hecla Consolidated. The company's current assets as of Dec. 31, 1935, were $318,626.99. Isle Royale was a high-cost producer, copper produced in 1932, the last year of operation, costing 12.55c. per pound before depreciation and depletion costs. Operations at the mine and mill were suspended the latter part of April, 1932. In December of the same year pumping operations ceased and the company decided to pull the pumps. The property has seven shafts, of which No. 4 and No. 5 were the principal operating shafts, being connected on the 34 level before the shutdown.

Iron Country

50,000,000-Ton Output Expected This Year

Large stripping programs now under way —Shipments from Lake Superior district in 1936 are 60 per cent above 1935 record

▶ The various mining operators are busy with stripping operations and making general repairs to equipment. The Interstate Iron Company has an extensive stripping program in progress at the Hill-Annex mine, at Calumet, Minn. This mine shipped over two million tons during the season of 1936, and it is therefore necessary to carry on rather extensive stripping programs, to provide area for mining the next season. The Oliver Iron Mining Company is stripping at the Morrison mine, at Coleraine; the Arcturus mine, at Marble, on the west end of the range, and also in Hibbing and other mines at the east end of the range. Unless hampered by labor troubles or strikes in the steel industry, the mining companies should expect a good season in 1937, with estimates running from 50,000,000 to 55,000,000 tons. So far as the Mesaba range is concerned, it is considered doubtful that any labor trouble will develop. The Farmer Labor party wishes to pass legislation that will increase taxation on the iron ore industry, but it is believed the Senate will oppose any radical moves in this direction.

▶ Shipments of iron ores by operating companies in the Lake Superior district during the season of 1936 were as shown in the accompanying table. Shipments in 1935 totaled 28,503,501 tons of ore.

Rank	Company	Tons
1	Oliver Iron Mining	17,370,525
2	Pickands Mather	9,385,928
3	Cleveland-Cliffs	3,993,837
4	Inter-State Iron	2,922,312
5	Republic Steel	2,513,295
6	M. A. Hanna	2,383,704
7	Butler Bros	1,314,388
8	Ogelbay Norton	1,071,120
9	Wisconsin Steel	895,519
10	Snyder Mining	816,005
11	Evergreen Mines	731,796
12	North Range Mining	576,250
13	Wheeling Steel	390,618
14	Inland Steel	314,255
15	Davidson Ore Mining	149,572
16	Charleson Iron Mining	137,536
17	Manganiferous Iron	129,786
18	Argonne Ore	68,830
19	York Iron Mining	60,829
20	Jackson Iron & Steel	20,733
21	Clement K. Quinn	10,335
22	Globe Iron	5,435
	Total	45,262,608

▶ The iron ore mined in the United States in 1936, exclusive of ore that contained 5 per cent or more manganese in the natural state, is estimated by the United States Bureau of Mines at forty-eight million six hundred and eighteen thousand gross tons, an increase of 59 per cent over the quantity mined in 1935. Production in 1936 was the largest since 193 , when 58,408,664 tons were mined. The ore shipped from the mines in 1936 is estimated at 51,380,000 gross tons, valued at $130,775,000, an increase of 54 per cent in quantity and of 57 per cent in total value compared with 1935. Shipments in 1936 were only 6.9 per cent less than in 1930 (55,101,221 tons).

The copper concentrator of the Britannia Minning & Smelting Company on Howe Sound, British Columbia, is about 28 miles from Vancouver. It is now operating at 80 per cent of its 6,000-ton capacity producing concentrates containing copper, and precious metals.

Canada

Paymaster Consolidated Plans Extension

Satisfactory results from prospecting and development encourage broader scale of operations—Siscoe finds ore in depth

▶ Pursuing an extensive development program during the past two years, the results of which are now considered satisfactory, Paymaster Consolidated is making plans leading toward a more extensive scale of operations. The probable program of expansion which the company will follow will be the deepening of No. 5 shaft to 2,000 ft. and reopening No. 4 shaft. A diamond-drilling program from the surface is planned for the coming summer. The company is speeding development so as to be ready by July 1 for an extensive mine examination. Ore reserves are reported to have been increased more than 17 per cent during the past six months and diamond drilling has determined the extension of veins considered to contain a profitable grade of ore. To maintain the company's good financial position, E. H. Walker, its president, has completed negotiations with Industro Mining Investment, Ltd., for another block of 200,000 shares, to be purchased in varying amounts, the last being due July 1, 1937. Charles E. Cook is mine manager at South Porcupine, Ontario.

▶ Development on eleventh and twelfth levels of the Sisco Gold Mines, in Quebec, has determined the extension of ore in the "K" zone. Drifting was recently started on the thirteenth level, where the ore was also found, and advance will be made soon from the fourteenth level shaft station.

▶ The value of mineral production in British Columbia in 1936 was estimated at $52,431,000 by the Department of Mines, an increase of 7.4 over that of the previous year. The principal factors in the increase were the higher price of lead that prevailed through the year and the greater quantity of gold mined. The London quotations for lead averaged 3.896c. a pound, whereas in 1935 the average was 3.133c. The output of gold amounted to 445,000 oz. Lead production was 353,000,000 lb., the largest production in the Province. The value of the zinc output, $8,226,000, was higher than in 1935, although the quantity was less. Only 20,300,000 lb. copper was produced in 1936, the lowest recorded since 1900. The decrease is attributable to the discontinuance of the Anyox operations in 1935. The advance in the price of the metal, however, and the increase in production of the Britannia company, which was practically doubled, offset to some extent that loss.

Gold recovered from placer operations during the year amounted to 35,000 oz. exceeding the production of any year since 1904. The most significant of the year's developments, however, was the improvement in the position of lead, zinc, and copper in the world markets. If these metals are maintained at their present price levels, the value of mineral production in 1937 may reach $62,000,000, within measurable distance of the record of $68,245,000 established in 1929.

▶ December output at the Cariboo Gold Quartz, situated at Wells, was 2,265 oz., valued at $79,275, from 6,422 tons of ore milled, according to the managing director, R. R. Rose. Ore reserves have been increased to about 175,000 tons, averaging 0.4 oz. gold, compared with 152,000 tons of approximately the same grade as at Jan. 31, 1936.

▶ In the Bridge River district, at the Bralorne, a promising vein was cut recently in a crosscut being driven at the eighth level to a point where a shaft

will be sunk for development at depth. The vein has been opened for a distance of 300 ft. to date, disclosing 250 ft. of ore. The width is narrow for the first 200 ft. but has increased to more than 4 ft. The indicated addition to ore reserves is very considerable. In December, according to the company's secretary, R. H. Grace, at Vancouver, 6,350 oz. of gold, valued at $223,250, was produced from 14,514 tons of ore.

▶ In the Kamloops district, at the Vidette mine, ore has been opened at the third level for a distance of 350 ft., carrying excellent values across an average width of 16 in. D. B. Sterrett, vice-president and consulting geologist, has been given charge of the mine, and Richard Avison has been appointed mine superintendent. The Jennie Long, in the same vicinity, is to be reopened and plans are being made to enlarge the mill to 50 tons' capacity.

▶ Operation of the new 50-ton mill at Gold Mountain, in the Hedley area, was commenced on Jan. 4. It is reported by Frank Dollemore, superintendent, that satisfactory results are being obtained in development.

▶ Since the new cyanide plant commenced operations at the end of December at the Wesko, near Ymir, augmenting the 100-ton flotation mill, recovery has been increased to 97 per cent. Arthur Lakes, the company's consultant, reports that in November and December about 5,000 tons of ore was milled, from which was produced 500 tons of concentrate averaging 1.7 oz. gold, 20 oz. silver, and 23 per cent lead.

▶ The outlook for Ymir Consolidated Gold Mines has been improved considerably in recent operations under J. B. Cowell. Milling was resumed in May after a period of idleness of several months. In October, 1,900 tons of ore was treated and production was valued at $31,000. A promising oreshoot has been opened in the old Ymir ground on the fourth level.

▶ High gold values have been obtained in a winze below the main crosscut level at Pacific Eastern, in the Bridge River area, adjoining Pioneer to the east, according to the manager Chas. R. Cox. Drifts are being advanced east and west from the winze 218 ft. below the collar in the hope that the width of the oreshoot will increase.

▶ It is understood that Congress Mines, with property adjoining the Minto, is negotiating with French interests to obtain funds for an intensive program of development. Equipment for the 100-ton mill which the company recently purchased from the Meridian Mining Company has arrived at the property and is being stored for the present.

▶ Production at the Hedley Mascot, in the Osoyoos district, was valued at $92,823 in December. The highest orebody, No. 3, has been entered by raises and its development is proceeding by tunneling and diamond drilling. It is intended to redeem the $330,000 note issue on April 15. W. R. Lindsay has resigned as manager to enter private practice and R. H. Stewart, consulting engineer, has been appointed managing director.

Mexico

Wage Increases Ward Off Labor Strikes

Companies also give economic benefits—Government announces it will further assist small-mine operators

▶ Midwinter found brighter conditions in the Mexican mining industry, though labor problems continued. Production is increasing in several mining regions and some new mines are being reopened. The government has announced that it is to further assist small scale operators this year by establishing seven metal-treatment plants in various zones.

▶ Operations are now normal at the copper properties. Villa de la Paz, San Luis Potosi, of Cia. Minera La Joya y Anexas, has resumed work after settlement of a strike. The company has reemployed all strikers and paid them 75 per cent of salaries during the period that the plant was closed.

▶ Mazapil Copper's Aranzazu smelter, Concepcion del Oro, Zacatecas, has resumed functioning after long idleness during which the plant was generally improved and the furnaces were modernized.

▶ Aviation service, mostly for mining firms in central and western Mexico, is to be on a permanent basis, as Cia. Lineas Aereas Mineras has obtained a federal franchise to operate regularly between Durango City, Mazatlan, and La Paz, Lower California.

▶ A free clinic for employees of its Avalos unit, Chihuahua is being established by Cia. Menera Asarco.

▶ Cia. Minera de Peñoles warded off a strike at its Concepcion del Oro unit, Zacatecas, by allowing the workers various demands, including higher pay. Increased wages are contingent upon silver prices holding to present levels. If they drop appreciably, the miners are to accept a 15 per cent wage cut.

▶ Daily production of gold-silver ore is to be increased by about 120 tons at the Campana properties, Altar region, Sonora, of Cia. Minera de La Libertad. The company is installing a 14½-ton Kennedy-Van Saun crusher. E. R. Boyd, of Tucson, Ariz., is general manager.

▶ Sierra Pinta mine, Sonora, operated by A. L. Richards, of Ajo, Ariz., recently shipped 25,000 lb. of gold ore and concentrates to El Paso smelters.

▶ Guanacevi Mining Company in Durango, is averaging a daily production of 110 tons of siliceous ore containing gold and silver, which is treated at the company's flotation plant. J. W. Swent is company general manager and S. A. Spellmeyer is superintendent.

▶ To prevent smuggling placer gold abroad by making it more profitable to market at home, President Lazaro Cardenas has exempted such metal from production taxes when it is sold to the Bank of Mexico for its metallic monetary reserves. Other gold production taxes remain unchanged as follows: in crude ore, 10.5 per cent; in concentrates, 10 per cent; in precipitates or bars alloyed with other metals, 9.25 per cent, and refined, 9 per cent.

▶ Arrangements to produce 100 tons of ore daily at its Zapote mine, near Cosala, Sinaloa, are being made by Neg. Minera de Guadalupe de los Reyes. This company also operates the Dolores mine, which has an output of 75 tons daily, and a flotation plant at La Esperanza that treats 50 tons a day. Ernesto Lorda, Apartado Postal 80, Mazatlan, Sinaloa, is president of this enterprise.

▶ Congress has granted President Lazaro Cardenas extraordinary powers to act in mining and other industrial legislation from Jan. 1 to Aug. 31. A new mining law is being drafted for his action. The government is to establish this year ore-treating plants at Tacubaya, Federal District; Tecamachalco, State of Puebla; Talpa, Jaliso; Real del Monte, Hidalgo; Guanacevi, Durango; Guanajuato, Guanajuato; and Bonanza, Zacatecas. President Cardenas announced the above information in his New Year's message and said that 1,280 concessions were granted to small miners during 1936.

▶ Cia. Minera La Herradura y Anexas, operating gold-silver mines at Real del Monte, Hidalgo, produced 10,610 tons ore in December which had an average of 2.60 grams gold and 490 grams silver per ton. The November production was 8,632 tons averaging 2.20 grams gold and 407 grams silver per ton.

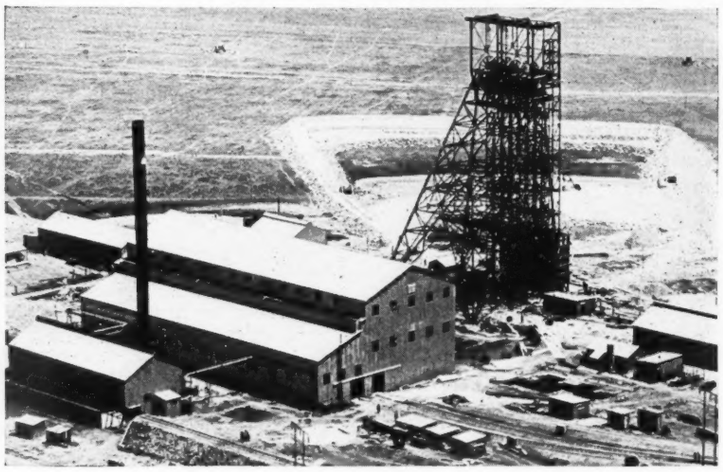
▶ A 50-ton flotation plant, handling concentrates yielding 500 grams of gold per ton, is being operated by Pacific Gold Mining, near Mazatlan, Sinaloa. F. E. Salas, Apartado Postal 63, Mazatlan, is managing director.

▶ Production of metals and minerals in Mexico during the first nine months of 1936, with comparable figures for the same time last year, according to the Mexican Department of Mines, was as follows, in kilograms:

	Jan.-Sept. 1935	Jan.-Sept. 1936
Gold	16,448	18,310
Silver	1,770,020	1,925,227
Copper	30,699,303	22,691,570
Lead	133,396,864	163,782,603
Zinc	103,214,448	115,970,851
Antimony	2,969,384	5,889,231
Graphite	4,985,478	7,319,255
Quicksilver	164,660	146,568
Arsenic	8,151,790	8,147,217
Molybdenum	915,673	615,963
Bismuth	166,327	136,967
Cadmium	473,026	403,163
Tin	520,927	300,000
Tungsten	46,591	37,035
Selenium	.....	280

▶ Production of copper by Compagnie du Boleo, Mexico, amounted to 1,825 metric tons during the fourth quarter of 1936. Production for the year was 7,095 tons, against 7,865 tons in 1935.

▶ Prospectors are investigating mineralized outcrops in the State of Colima, which has only one mining enterprise, the Mamey unit of the Cia. Fundidora de Acero y Hierro de Monterrey.



A world's record in shaft sinking was performed in the Vlakfontein No. 1 shaft, shown above, advancing 422 ft. in one month. Development here is considered to be foremost in the Far East Rand, where the main reef is estimated to be met at about 6,350 ft. When this horizon is reached a main haulage will be driven to connect with a heading from the Sub-Nigel. This will also afford deep ventilation

Africa

Mufulira Copper Starts New Smelter

First blister produced in January—Roan Antelope operating on full quota basis—Nchanga copper mine being unwatered

▶ Without waiting for the formation of the new company which is to take them over from Rhokana Corporation, preliminary work on the unwatering and development of the Nchanga-West properties has been started. It is commonly understood and agreed that this will be the most difficult of all the copper developments undertaken in Central Africa, as the ore lies at a considerable vertical depth, is a relatively horizontal deposit, and, until the ground has been drained, a great volume of water will have to be pumped. But the tonnage and grade of the ore to be won far more than justify the work and expense. Sir Auckland Geddes says: "It is obvious that some years must elapse before copper production on a commercial scale can commence." The work now beginning will add another to the world's major copper producers.

▶ Mufulira Copper Mines has started up its smelter, the first blister copper being produced on Jan. 7. From now on its entire output of concentrates will be smelted in its own plant. The company's production is rapidly being raised to conform to its increased output quota. The maximum capacity of the smelter is estimated to be around 100,000 long tons of copper annually.

▶ Roan Antelope is understood to be producing the full amount allowed it under the quota system agreement. A further important reduction in this company's production costs is in prospect. The fine-crushing equipment installed last year is effecting a saving which more than offsets the cost of grinding the harder ore which is coming from the deeper workings.

▶ The December output of Rhodesia Broken Hill Development Company was 1,750 long tons of electrolytic zinc, 90 tons of vanadium concentrates, and 11½ tons of fused vanadium.

▶ For the first ten months of 1936 the mineral production of Northern Rhodesia had a value of £4,784,330, an increase of £505,946 over the corresponding period in 1935. Since the end of October the price of standard copper has advanced £8 per ton, and the Northern Rhodesia output, 11,588 tons in that month, is now much larger.

South Africa

Demand for Diamonds Increasing

Mines in Kimberley more active—Sharp advance in building in Johannesburg reflects expansion in gold mining

▶ Advices from Kimberley state that the Dutoitspan diamond mine is to be operated on double shift, beginning immediately. The demand for diamonds is said to be increasing rapidly.

▶ The amazing advance in building activity in South Africa, and particularly in Johannesburg, is clearly evidenced by the statistical returns for the first ten months of 1936, which show that every month of the year building plans worth at least $3,750,000 have been passed in Johannesburg. In the second half of the year this average has even been exceeded; so that it would not be surprising if 1936 recorded the passing of building plans of over $50,000,000. As it is more than likely that the rate of expansion continues, the centre of the Witwatersrand gold fields is headed for a monthly new building estimate of $5,000,000, or $60,000,000 a year. This, of course, has arisen primarily out of the expansion of the gold-mining industry, which even today is only at the beginning of an era of still greater growth. The public, so far, has been inclined to view with some skepticism the possibility of important reef discoveries in the Lichtenburg-Ventersdorp area, northeast of the Far West Rand, and in the Bothaville district, in the northern Orange Free State, these representing large potential new gold fields.

▶ The scale on which development on gold mines is progressing is indicated by the following figures for October, 1936: Rock drills in use, 7,748; main shaft sinking, 6,565 ft.; adits, main drives, crosscuts, 117,766 ft.; other development, 84,774 ft., and tons of rock hoisted, 5,479,970.

▶ The "Safety First" movement on the Witwatersrand was started many years ago, and its activities have resulted in a remarkable reduction in the accident and mortality rates on the mines. Latest statistics published show that the death rate from accidents for the first ten months of 1936 amounts to 2.10 per 1,000, the average number of employees being 321,841. With nearly 69,000 fewer employees in 1933 the fatal accident rate was 2.35 per thousand; in 1934 the rate was 2.11, and in 1935 the low record of 2.02 per thousand for nearly 300,000 employes was achieved.

▶ The Transvaal Chamber of Mines states that the December output of gold in South Africa was 970,030 oz. (Witwatersrand 948,430 oz. and outside districts 21,600 oz.). Total production for the year was 11,339,411 compared with 10,776,684 in 1935. The high record of all time was 991,322 oz. in August, 1932.

SPANISH COPPER ORE SHIPPED TO GERMANY

IT IS REPORTED that the Insurgent-Franco government in Spain has sold some 370,000 tons of copper ore to the Germans, arranging for immediate shipment. The ores are from Rio Tinto and the Tharsis Sulphur & Copper mines owned in England, and the Pyrite de Huelva, a French company. It is apparent that the object of the Insurgents is to obtain foreign currency, as they propose to pay the companies for the ores in pesetas, while selling them for marks and sterling.

Australia

British Aluminum Co. To Build Plant

Raw material will be imported and aluminum manufactured in a plant to be constructed in Tasmania—Mount Lyell ore reserves increase

▶ Electrolytic Zinc Company of Australasia, Ltd., is to undertake the manufacture of aluminum in Australia and in conjunction with the British Aluminum Company, Ltd., has formed British Aluminum (Australia) Pty. Ltd., with a nominal capital of £300,000 in £1 shares. The plant will probably be located at Risdon, Tasmania, and the purified alumina will be imported. At present there are no large developed deposits of bauxite in Australia. Imports of aluminum into Australia in 1934-35 were 1,400 tons, principally as plates, sheets, and pigs. The Electrolytic Zinc Company is associated with the Commonwealth Aircraft Corporation, which is to undertake the production of airplanes in Australia. This new industry will afford larger markets for aluminium. H. St. J. Somerset is general manager of the Electrolytic Zinc Company, with office at Risdon, Tasmania.

▶ Mount Lyell Mining & Railway Company, Ltd., Mount Lyell, Tasmania, milled 665,422 tons assaying 2.06 per cent copper during the twelve months ended Sept. 30, 1936, making 50,628 tons of flotation concentrate assaying 24.9 per cent copper. The recovery was 92.1 per cent. By reflotation of the mill tailings, 31,812 tons of pyrite concentrate, assaying 49.6 per cent sulphur, was produced for use by an associate company engaged in the manufacture of sulphuric acid. The output of blister copper was 12,803 tons, compared with 12,666 tons in the previous period. The cost of mining was 8.8s. per ton and of milling 2.7s. per ton. About 60 per cent of the ore is now won by opencutting the West Lyell and Prince Lyell orebodies. Ore reserves have again been increased to 8,825,000 tons assaying 1.90 per cent copper. This includes 1,000,000 tons of ore in the Prince Lyell assaying 1.25 per cent copper. Net profit was £187,291, an increase of £121,379 on 1934-35. R. M. Murray is general manager of the company.

▶ Mount Morgan, Ltd., Queensland, milled 259,929 tons assaying 4.25 dwt. gold per ton and 0.67 per cent copper during the twelve months ended June 30, 1936. This is an increase of 82,149 tons compared with the previous year's record. The flotation plant produced for export to the United States of America 9,538 tons of concentrates containing 35,618 oz. of gold and 1,513 tons of copper. Mining and milling costs totaled 14s. 11d. per ton, as against 17s. 11d. in 1934-35. The net profit was £104,961, compared with £110,432 in 1934-35. Ore reserves are: Sulphide ore, 7,506,000 tons assaying 4.26 dwt. gold per ton and 1.77 per cent copper. Oxidized ore, 1,500,000 tons assaying 2.7 dwt. gold. A new sulphide orebody outside the limits of existing ore reserves has been located and exploration is in progress. The new oxidized ore-treatment plant, which has a capacity of 800 tons daily, recently started operations. The sulphide treatment plant has been extended and now handles 1,200 tons daily. A. F. McAskill is general manager of Mount Morgan, Ltd., and T. M. Owen is technical advisor.

▶ Western Australian gold yield for the eleven months ended Nov. 30, 1936, is 757,144 oz. fine, or 108,806 oz. more than for the whole of 1935. The yield for 1936 will be 810,000 fine ounces, the highest for eighteen years.

▶ Excellent yields continue from the Lancefield mine, at Beria, W. A., which was reopened after being idle since 1920. For the three months ended Nov. 30, 1936, 31,340 tons was treated for a return valued at £80,293, giving a working profit of £43,510. The costs were 23s. 6d. The ore is treated by flotation.

▶ Rich returns are reported from the Cox's Find mine of Western Mining Corporation, at Erlistoun, W. A. On the No. 2 level the lode has widened at the shaft crosscut to 16 ft. assaying 15 dwt.

▶ Bendigo's gold yield for November was 3,919 oz. fine, an increase of 558 oz. fine compared with November, 1935. Production for the eleven months ended November, 1936, is 34,926 fine ounces, or 4,443 fine ounces more than for the corresponding period of last year. Three more treatment plants will be in operation next year and should give a further gain in output.

▶ Cocks Pioneer Gold & Tin Mines, N. L., Eldorado, Vic., which is the largest hydraulic sluicing undertaking in Australia, cleaned up 1,129 oz. of gold and 15.5 tons of tin oxide from 172,000 cu.yd. for its No. 11 run. The estimated value of the yield is £12,841. Costs at 8d. per cubic yard give a profit of £7,000.

▶ Wattle Gully Gold Mines, N. L., Chewton, Vic., has treated to Dec. 10, 4,233 tons for 2,171 oz. gold. A 20-head battery has been erected and the latest crushing is 660 tons for 344 oz. A reef 6 ft. wide is being worked on the 575-ft. and 655-ft. levels. A first dividend of 1s. per share, absorbing £3,000, has been paid. J. Till is mine manager.

▶ A.1. Consolidated, operating at Woods Point, Vic., treated 3,680 tons during 1936 for 1,701 oz., equivalent to 9.2 dwt. This compares with an average of 3.7 dwt. during 1935. The quartz reefs zigzag at a flat angle across a bulge in a persistant diorite dike. The mine is equipped with a 20-head battery and concentrating tables. Morning Star mine, which has been giving highly profitable yields, is 10 miles away.

▶ Sandy Creek Gold Sluicing, N. L., Wau, New Guinea, is recovering by sluicing 280 oz. monthly from 9,800 cu.yd., giving a return of 4s. 4d. per cubic yard. A large quantity of wash remains to be treated.

▶ New Guinea gold exports for the twelve months ended June 30, 1936, are valued at £1,704,498, compared with £1,897,244 for 1934-35. A large increase is expected during 1936-37.

▶ Austral New Zealand Mining, Ltd., a subsidiary of Austral Malay Tin, Ltd., has called tenders for a large electric bucket dredge, capacity 3,500,000 cu.yd. per annum, to be erected on the Clutha River, Otago, New Zealand. The area contains 56,000,000 cu.yd. averaging 3 grains per cubic yard.

Underwood & Underwood

Uncle Sam's gold mine requires no calculation of ore reserves, erection of tall headframe, use of rock drills, flotation plant, or smelter. The gold bullion is already deposited underground beneath this artistic building near Fort Knox, Kentucky, and its value is about $7,000,000,000.

PERSONAL ITEMS

Dr. Charles Camsell has been elected vice-president of the Geological Society of America.

J. Owen Ambler, formerly at Huelva, Spain, for the Rio Tinto Company, has returned to the United States.

R. H. Stewart has been appointed managing director of the Hedley Mascot Mine, in British Columbia.

F. J. De Wilde, consulting engineer, is visiting points in Nevada and Arizona on business.

R. J. Lemmon, metallurgical engineer with Imperial Chemical Industries, Ltd., is visiting southern Europe.

Preston K. Horner, managing director of the Siamese Tin Mines, Ltd., is in Siam on a visit of inspection.

W. R. Lindsay, former manager of the Hedley Mascot mine, in British Columbia, has resigned to enter private practice as consulting mining engineer.

A. P. Wichmann has joined the faculty of the Colorado School of Mines as assistant professor in the department of metallurgy.

W. B. Lenhart, metallurgical engineer, has been appointed mill superintendent for the Cardinal Gold Mining Company, Bishop, Calif.

William Pearce is doing surveying work for Kiena and Wisik gold mines, on Parker and Mocassin islands, respectively, in Lake Montigne, Quebec.

Dr. F. E. Keep, mining engineer of the staff of Central Mining & Investment Corporation, Ltd., is on a business visit to Australia.

Charles M. Hannum, recently with Canyon Placers, Inc., at Dedrick, Trinity County, Calif., is now with the National Tool Company, Cleveland, Ohio.

Jesse J. MacDonald has left his headquarters at 528 Heliotrope Drive, Los Angeles, to do consulting work on the properties of the Rob Roy Development Company near Kofa, Ariz.

George D. Bellows recently left New York City to spend the next few months investigating mining properties in British Guiana. His headquarters will be at the Park Hotel, Georgetown.

James A. Pike has accepted a position as engineer in charge of the Tombill Gold Mines, Ltd., at Geraldton, Ont., which property is operated by a subsidiary of Newmont Corporation, of New York.

Durant Barclay, of Marble, Minn., formerly safety engineer for the Oliver Iron Mining Company in the Coleraine district, has been appointed superintendent of the Arcturus mine, at Marble, Minn.

L. C. Hill, technical deputy manager of the Rio Tinto Company, was in New York last month.

Henry W. Kaanta, metallurgical engineer, was in New York City recently on a business trip. He returned to Denver, Colo., on Feb. 6.

José Cerrillo, Jr., has accepted the position of *responsable* and engineer in charge of the mine for the Compania Candelaria-Canoas, S. A., at Estacion, Lodemena, Zacatecas, Mexico.

HAROLD P. GREENWALD

Harold P. Greenwald has been appointed a supervising engineer of the Pittsburgh Experiment Station of the United States Bureau of Mines. He succeeds **William P. Yant,** who recently resigned to accept an executive position with an industrial concern. Mr. Greenwald, a native of Boston, Mass., has been in the service of the Bureau of Mines since 1914.

Arthur D. Stork, managing director of Roan Antelope, Rhodesian Selection Trust, and Mufulira mines, is returning to London from a winter vacation in Switzerland.

Arnold B. Black has been appointed assistant undergound manager of Broken Hill South, Ltd., Broken Hill, New South Wales. He was formerly chief surveyor.

H. R. Taylor has been appointed mill superintendent of the Allenby (B. C.) plant of Granby Consolidated Mining, Smelting & Power Company, which shut down in 1930. Mr. Taylor held the same position from 1925 to 1930.

Charles G. Foreman is now on the staff of the engineering department of and Nevada Consolidated Copper Corporation at Ray, Ariz.

R. B. McGinnis, recently manager of the Golden Center Mines, Inc., at Baker, Ore., has returned to New York City to resume his practice as a mining engineer, with offices at 31 Nassau St.

Archibald B. Scott, formerly consulting mining engineer at Denver, Colo., is now acting as chief of party on a W.P.A. project involving water-conservation work surveys in northwestern Wisconsin.

Charles L. Pillar has left the Park City Consolidated Mines Company at Park City, Utah, to accept a position in the engineering department of the St. Joseph Lead Company, at Desloge, Mo.

G. L. H. Loram, consulting geologist and mining engineer, sailed recently from San Francisco for Manila, P. I. He can be reached by addressing mail in care of Atkins, Kroll & Company, Manila, P. I.

Benton Boyd, mining engineer, until recently with Empire Star Mines Company, Ltd., Grass Valley, Calif., is now with the United States Smelting, Refining & Mining Company at Bingham Canyon, Utah.

J. A. Siefert, mining engineer and geologist, has returned to Seattle, Wash., after three months spent on the Nicholson Creek Mining Corporation's property at Usk, B. C. He plans returning to the North.

Harold B. Ewoldt has resigned as senior foreman of construction and maintenance in the United States Forest Service to become mine superintendent at the Hunter mine of the Gregory Bates Mining Company, at Black Hawk, Colo.

William P. Chinn, of Duluth, Minn., retired as general manager of mines for Pickands, Mather & Company on Jan. 1. He was succeeded by **A. D. Chisholm,** of Duluth, who has been his assistant.

John N. Butler sailed for the Philippines in November last to accept a position with Suyoc Consolidated Mining Company, a Marsman & Company property, at Baguio, Mountain Province, P. I.

Enoch Perkins, manager of chrome-ore mines for the Mutual Chemical Company of America, returned to New York from New Caledonia on Jan. 22, coming by way of London, owing to the seamen's strike on the Pacific Coast. His journey included a transcontinental trip across Australia.

George A. Morrison, after having spent ten years as superintendent of mines for the West Penn Cement Company, West Winfield, Pa., has accepted the position of general manager of the Orogrande-Frisco Gold Mines, Inc., at Orogrande, Idaho.

Heath Steele, vice-president of the American Metal Company, left New York on Jan. 8 to make an inspection trip, during which he will visit properties in Mexico and the Southwest. He will return in seven or eight weeks.

J. B. Tyrell expects to spend much of the coming summer visiting and inspecting gold mines in northern Canada, especially some of those more recently developed.

Norman Hickman, manager of sales for the American Metal Company, has been made a director on the board of the company. He has been associated with the company for twenty years.

Paul Palén, of Stockholm, Sweden, is preparing to make an extended trip to South America, and eventually, also, to South Africa. He will probably be absent from Stockholm for several months.

Guy H. Ruggles has resumed his position of mill superintendent for Inspiration Consolidated Copper Company, at Inspiration, Ariz., after serving for a year in the same capacity for Mountain City Copper Company, at Mountain City, Nev.

Rae L. Johnston is now acting as managing director of Johnson & Witcher Mines, Inc., at Oatman, Ariz. The company has under lease and bond the Big Jim and Western Apex mines, at Oatman; the Tintick mine, at Chloride, and the Big Horse Shoe, at Kingman.

John Melhase, of Berkeley, Calif., has been reelected president of the California Federation of Mineralogical Societies. **Dr. John Herman,** of Los Angeles, is vice-president of the Federation and **Everett W. Chapman,** of Los Angeles, secretary-treasurer.

Walter F. Pond, State Geologist of Tennessee, announces that the Tennessee Division of Geology, **Walter F. Pond,** State Geologist, has just moved into its new quarters at 426 Sixth Ave. North, Nashville, where all mail and mineral specimens should be sent.

T. H. Jenks has removed from Los Angeles to Denver, in order to be nearer to operations in which he is professionally interested at Coeur d'Alene mine, at Central City, Colo., and the Gold Range properties at Bland, N. M.

H. O. Woods, who has been in charge of the copper department of the El Paso smelter of the American Smelting & Refining Company, has been transferred to Hayden, Ariz., with the reopening of the Hayden smelter. He will be assistant superintendent.

R. M. Hux has left his position as mill superintendent for Compañia Minera de Los Azules, Santa Barbara, Chihuahua, Mexico, and will sail on March 1 for the Philippine Islands to accept the position of mill superintendent for the Masbate Consolidated Mining Company of Rio Guinobatan, Masbate, P. I.

Dr. Arthur P. Coleman, professor emeritus of the University of Toronto, was recently awarded the Penrose Medal of the Geological Society of America. The award to Dr. Coleman was "in recognition of eminent research in pure geology and outstanding original contributions which mark a decided advance in the science of geology." Dr. Coleman is 84 years old.

Dr. Frederick Gardener Cottrell, of Washington, D. C., former Director of the United States Bureau of Mines and of the fixed-nitrogen laboratory of the Department Agriculture, who perfected the process by means of which the cost of helium gas was reduced from $1,700 to 10c a cubic foot, has been chosen to receive the Washington award for 1937, for his "social vision in dedicating to the perpetuation of research the rewards of his achievements in science and engineering."

Quirico A. Abadilla, one of the outstanding Filipino mining engineers, has been appointed head of the new Philippine Bureau of Mines. The appointment took effect Jan. 1, 1937. A graduate of the Colorado School of Mines, in the class of 1920, Mr. Abadilla has had varied mining experience in Colorado and in South America. He has been in government service, in the division of mines of the Bureau of Science, since 1933. The sum of 100,000 pesos has been appropriated for the first year's work of the new Bureau, which is to be built on the division of

QUIRICO A. ABADILLA

mines. The main difficulty which will face Mr. Abadilla in building his organization will be that of obtaining capable mining engineers. Practically every mining engineer connected with the division of mines has resigned to accept more lucrative positions with newly formed companies.

J. S. Baker is now consulting engineer for Opisso & Company, Inc., mine managers and operators throughout the Philippines. He writes that the company is working several properties and has several more under consideration. Several engineers from the United States are expected to join the staff of the company soon, among them **J. McLaren Forbes,** formerly in Superior, Ariz.; also, **Donald R. McLaren,** formerly with the Inspiration Consolidated Copper Company. **Dean Albee,** who has been in the Philippines for several years, has joined the staff of the company, as has **A. P. Bowie,** formerly in Malaya and more recently assistant superintendent of Coco Grove, Inc., placer operators in the Philippines.

OBITUARY

T. J. Welcker, 46, chief geologist for the Snyder Mines, Inc., died on Dec. 22. He was an alumnus of the Michigan School of Mines.

George H. Barnhart, formerly superintendent and general manager of Ymir Gold Mines, West Kootenay, B.C., died in Denver on Jan. 27.

Albert C. Wilson, for many years superintendent of Utica Mining Company, died recently at Angels Camp, Calif., aged 64.

Keith R. Miller, long prominent in Plumas County mining circles and as manager of Seneca Consolidated Gold Mining Company, died in Seneca, Calif., on Nov. 7. He was 72 years old.

James K. Cole, 28-year-old American mining engineer, was found dead of a gunshot wound in his room in a Mexico City hotel Jan. 6. Cole had been sent by his uncle, David Cole, El Paso mining man, to examine mineral tracts in Jalisco.

Charles A. Richardson, a distinguished Canadian mining engineer, prominently identified with the development of many mining districts in the Dominion, died in Winnepeg on Dec. 22 last at the age of 77.

Hugh B. McDermott, former safety engineer for the Utah Copper Company and in the United States Bureau of Mines, died in Salt Lake City on Jan. 7. He was 44 years old.

Dr. William Henry Collins, formerly Director of the Canadian Geological Survey, and consultant to the mines and geology branch of the Department of Mines and Resources, died on Jan. 14 at the age of 58. In 1933 he was elected president of the Geological Society of America.

Charles Hayden, senior partner of the firm of Hayden, Stone & Company, of New York, banker, financier, and industrialist, and an officer and director in 58 corporations, died in New York on Jan. 8. He was 66 years old. Mr. Hayden was an alumnus of the Massachusetts Institute of Technology (B.S.), where he specialized in economics and mining engineering. His firm played a large part in the development of several important copper properties. He was also interested in the development of zinc and nickel mining. At the time of his death Mr. Hayden was chairman of the board of International Nickel and chairman of the finance committees of Kennecott and Utah Copper. In his will, Mr. Hayden, after making minor bequests, bequeathed $1,000,000 to the Massachusetts Institute of Technology and provided about $50,000,000 for the establishment of a Youth Foundation, to advance "the moral, mental, and physical well-being of boys."

Summary of the

MARKETS

THOUGH labor disturbances in the automobile industry and damaging floods in the Ohio Valley retarded business activity during January, particularly toward the end of the month, the slackening in operations, compared with December, was not pronounced. Early in the month, on continued buying of copper and other major metals in London at higher prices, the market here strengthened. Copper and zinc made new highs for the movement. Lead was firm but unchanged. Tin fell below 50c. per pound on the impression that under the new control plan stocks should increase. Washington was silent on the subject of silver and the market presented a slightly easier tone on foreign metal.

The *E.&M.J.* index of non-ferrous metal prices for January advanced sharply to 87.03. This compares with 80.50 in December, and 72.25 in January, 1936.

Copper buyers became excited as the upward trend in prices was resumed abroad. With prompt and near-by metal in scanty supply here, producers lost no time in raising the domestic quotation to the basis of 13c., Connecticut, the highest price since May 5, 1930. London prices were a little unsettled after the statistics for December revealed that stocks abroad increased 10,361 tons. Here this news had little influence, largely because our surplus was reduced by 10,247 tons. Stocks of refined for the world (Copper Institute) at the end of December totaled 353,150 tons, against 353,036 tons a month previous.

Effective Jan. 14, all restrictions on foreign production of copper were removed. It was announced, however, that the participants in the control plan agreed on certain conditions under which curtailment will, if necessary, again become effective.

Domestic sales of copper during January totaled 53,815 tons, against 117,715 tons in December.

Stocks of refined lead decreased to 172,423 tons by the end of December, a reduction of 4,537 tons for the month. Uncertainty as to just how much production will be stimulated by the higher prices caused sellers to hold to the 6c. basis.

The advance in London made it possible for domestic producers of zinc to raise the quotation for Prime Western to 6c., St. Louis. Statistically, the market here has been in a strong position for months, with consumption rising steadily. Zinc concentrate in the Joplin, Mo., market advanced to $39 per ton.

Buying of platinum, chiefly in London, greatly strengthened the views of sellers, and the price was raised to $68 on Feb. 1.

UNITED STATES MARKET

1937 Jan.	Electrolytic Copper Domestic (a)	Electrolytic Copper Export (b)	Straits Tin New York	Lead New York	Lead St. Louis	Zinc St. Louis
1	Holiday	11.650	Holiday	Holiday	Holiday	Holiday
2	11.775	11.625	51.650	6.00	5.85	5.45
4	11.775	11.650	51.250	6.00	5.85	5.45
5	11.775	11.650	50.950	6.00	5.85	5.45
6	11.775	11.575	51.000	6.00	5.85	5.45
7	11.775	11.675	51.375	6.00	5.85	5.45
8	11.775	11.750	51.325	6.00	5.85	5.55@5.60
9	11.775	11.950	51.200	6.00	5.85	5.60
11	11.775@12.275	12.200	51.325	6.00	5.85	5.80
12	12.275	12.325	51.125	6.00	5.85	5.90@6.00
13	12.275	12.350	51.000	6.00	5.85	6.00
14	12.275@12.775	12.550	51.150	6.00	5.85	6.00
15	12.775	12.475	51.500	6.00	5.85	6.00
16	12.775	12.400	51.500	6.00	5.85	6.00
18	12.775	12.350	51.325	6.00	5.85	6.00
19	12.775	11.975	51.000	6.00	5.85	6.00
20	12.775	12.075	51.100	6.00	5.85	6.00
21	12.775	12.300	51.100	6.00	5.85	6.00
22	12.775	12.300	51.000	6.00	5.85	6.00
23	12.775	12.350	50.900	6.00	5.85	6.00
25	12.775	12.175	50.050	6.00	5.85	6.00
26	12.775	12.225	50.350	6.00	5.85	6.00
27	12.775	12.350	50.100	6.00	5.85	6.00
28	12.775	12.325	50.150	6.00	5.85	6.00
29	12.775	12.325	49.850	6.00	5.85	6.00
30	12.775	12.325	49.850	6.00	5.85	6.00
Average For Month	12.415	12.112	50.925	6.00	5.85	5.847
AVERAGES FOR THE WEEK						
Jan.						
6	11.775	11.625	51.300	6.00	5.85	5.450
13	11.983	12.042	51.225	6.00	5.85	5.729
20	12.733	12.304	51.263	6.00	5.85	6.000
27	12.775	12.283	50.583	6.00	5.85	6.000
CALENDAR WEEK AVERAGES						
Jan.						
2	11.563	11.579	51.850	6.00	5.85	5.450
9	11.775	11.708	51.183	6.00	5.85	5.496
16	12.442	12.383	51.267	6.00	5.85	5.958
23	12.775	12.225	51.071	6.00	5.85	6.000
30	12.775	12.288	50.058	6.00	5.85	6.000

SILVER, GOLD, AND STERLING EXCHANGE
NEW YORK AND LONDON

1937 Jan.	Sterling Exchange "Checks"	Sterling Exchange "90-day demand"	Silver (c) New York	Silver (c) London	Gold London	Gold (d) United States
1	Holiday	Holiday	Holiday	Holiday	Holiday	Holiday
2	4.90750	4.90000	Holiday	Holiday	Holiday	$35.00
4	4.90875	4.90125	45.000	21.2500	141s 8 d	35.00
5	4.91500	4.90875	45.000	21.3125	141s 5½d	35.00
6	4.91125	4.90500	45.000	21.1875	141s 5½d	35.00
7	4.90875	4.90250	45.500	21.3125	141s 7 d	35.00
8	4.91125	4.90500	45.250	21.1875	141s 7 d	35.00
9	4.90875	4.90250	(e)	21.1250	141s 6½d	35.00
11	4.90875	4.90250	45.375	21.2500	141s 8 d	35.00
12	4.91125	4.90375	45.125	21.1250	141s 6½d	35.00
13	4.91000	4.90250	45.000	21.0000	141s 7 d	35.00
14	4.90875	4.90250	44.750	20.6250	141s 8 d	35.00
15	4.91000	4.90375	44.750	20.8125	141s 7 d	35.00
16	4.91000	4.90375	(e)	20.4375	141s 7½d	35.00
18	4.91000	4.90375	44.750	20.4375	141s 7½d	35.00
19	4.90875	4.90125	44.750	20.5000	141s 7½d	35.00
20	4.90750	4.90000	44.750	20.3750	141s 8½d	35.00
21	4.90375	4.89750	44.750	20.5000	141s 9½d	35.00
22	4.90375	4.89625	44.750	20.4375	141s 10½d	35.00
23	4.90250	4.89500	(e)	20.3750	141s 10d	35.00
25	4.90375	4.89625	44.750	20.4375	141s 9½d	35.00
26	4.90625	4.89875	44.750	20.4375	141s 8½d	35.00
27	4.90000	4.89250	44.750	20.4375	141s 11d	35.00
28	4.89750	4.89000	44.750	20.5000	141s 11d	35.00
29	4.89750	4.88875	44.750	20.3125	141s 11½d	35.00
30	4.89625	4.88750	(e)	20.2500	142s	35.00
Av. for month	4.90670	.....	44.913	20.734	.....	35.00
AVERAGES FOR THE WEEK						
Jan.						
6	4.91050	.....	45.000	.....	.....	.....
13	4.90979	.....	45.250	.....	.....	.....
20	4.90917	.....	44.750	.....	.....	.....
27	4.90333	.....	44.750	.....	.....	.....

Calendar week averages: New York Silver, Jan. 2nd, 45.156; 9th, 45.150; 16th, 45.000; 23rd, 44.750; 30th, 44.750.

(e) No quotation (Saturday).

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis, add 0.225c. per pound, the average differential for freight and interest charges.

(b) Export prices are net at refineries on the Atlantic seaboard and include sales of domestic copper in the foreign market. Most sales in the foreign market are made on the basis of c.i.f. usual ports of destination—Hamburg, Havre, and Liverpool. The c.i.f. basis commands a premium of 0.300c. per pound above our refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West in nearly all instances command a premium of 1c. per pound over the current market for Prime Western but not less than 1c. over the *E. & M. J.* average for Prime Western for the previous month.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

(c) Silver other than newly mined domestic. Under Executive order issued April 24, 1935, the U. S. Government's price on newly mined domestic silver was established at 77.57. Handy & Harman's quotation for domestic silver, .999 fine, was 77c. per ounce throughout January.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold in domestic and imported ore or concentrate is at 99.75 per cent of the price quoted by the Treasury, which at present is equal to $34.9125 per ounce.

PRICES OF METALS • MISCELLANEOUS QUOTATIONS

LONDON MARKET

1937 Jan.	Copper Standard Spot	Copper Standard 3M	Copper Electrolytic Bid	Tin Standard Spot	Tin Standard 3M	Lead Spot	Lead 3M	Zinc Spot	Zinc 3M
1				Holiday					
4	49.5000	49.7500	54.5000	231.0000	231.5000	27.1250	27.1250	19.9375	20.3125
5	48.3750	48.6875	53.5000	228.3750	229.0000	26.6250	26.5625	19.0625	19.3750
6	48.8750	49.1250	53.7500	228.7500	229.7500	26.5625	26.4375	18.4375	18.7500
7	49.5000	49.6875	54.2500	230.7500	231.5000	27.3750	27.2500	19.3125	19.6250
8	50.4375	50.6875	55.0000	231.2500	232.0000	27.5625	27.3750	20.0000	20.3750
11	53.0000	53.1250	57.2500	230.5000	231.5000	28.1875	28.0000	20.6875	20.9375
12	51.4375	51.6250	56.0000	230.5000	231.5000	28.2500	28.0625	21.9375	22.0625
13	54.2500	54.2500	59.0000	231.0000	231.7500	28.5625	28.4375	22.7500	22.8125
14	53.2500	53.3125	58.0000	231.2500	232.2500	28.1250	28.0625	22.6250	22.8125
15	52.8750	52.8750	57.7500	232.2500	233.0000	27.6875	27.6250	22.5625	22.7500
18	52.3125	52.3750	57.2500	231.7500	232.5000	27.1875	27.1875	21.6875	21.9370
19	50.3125	50.4375	55.0000	229.5000	230.0000	26.5625	26.5625	20.2500	20.5000
20	51.4375	51.5000	56.0000	229.5000	230.0000	27.3125	27.1250	21.2500	21.3125
21	52.5000	52.6250	57.5000	230.5000	231.5000	27.9375	27.8125	22.3750	22.5000
22	52.2500	52.3750	57.5000	230.0000	230.5000	26.9375	26.8750	22.0000	22.0000
25	51.3125	51.4375	56.0000	226.5000	227.3750	26.6250	26.5000	21.5000	21.2500
26	51.8750	52.0000	57.0000	226.2500	226.7500	26.5625	26.4375	21.8750	21.7500
27	52.4375	52.5000	57.0000	227.0000	227.5000	27.2500	27.0000	21.8125	21.6875
28	51.8750	52.0000	56.7500	225.3750	226.0000	26.6875	26.5000	21.6875	21.5625
29	52.1250	52.2500	56.7500	225.0000	225.5000	26.3125	26.0625	21.3125	21.3125
Average for month.	51.497	.....	56.288	229.350	.....	27.272	27.150	21.153	21.281

CURRENT PRICES—MISCELLANEOUS METALS, ORES, AND NON-METALLIC MINERALS

Quotations cover wholesale lots, prompt shipment, f.o.b. New York, unless otherwise stated

(February 1, 1937)

MISCELLANEOUS METALS

Aluminum, ingot, 99 plus per cent, lb.	19@20c
Antimony, domestic, spot, lb.	14.250
Bismuth, ton lots, lb.	$1.00
Cadmium, lb.	75c@$1.05
Chromium, 97 per cent grade, lb.	85c.
Nickel, electrolytic cathodes, lb.	35c.
Magnesium, 99.8 per cent, carloads, lb.	30c.
Palladium, troy oz.	$24.00
Platinum, (official quotation) troy oz.	$68.00
Quicksilver, flask of 76 lb., 100 flasks or more	$88.50@$91.00
Radium, mg. radium content	$40.00
Selenium, 99.5 per cent, lb.	$2.00
Silicon, minimum 97 per cent, spot, lb.	16.50c.
Tellurium, lb.	$1.75@$2.00
Thallium, 100 lb. or more, lb.	$6.50
Titanium, 96 to 98 per cent, lb.	$6.00
Zirconium, commercially pure, lb.	$7.00

METALLIC ORES

Beryllium Ore, f.o.b. mines, ton	$30.00@$35.00
Chrome Ore, 45@47 per cent, c.i.f. Atl. ports, long ton	$18.00@$19.00
Iron Ore, Lake Superior, lower Lake ports, long ton:	
Old Range bessemer	$4.80
Mesabi bessemer	$4.65
Old Range non-bessemer	$4.65
Mesabi, non-bessemer	$4.50
Lead (Galena) 80 per cent Joplin, Mo., ton	$69.50@$70.93
Manganese Ore, c.i.f. Atlantic ports, long ton unit:	
52@55 per cent	34c.
49@51 per cent	32c.
44@47 per cent	27c.
Molybdenum Ore, 90 per cent, per lb. of contained MoS_2	42c.
Tungsten Ore, per unit of WO_3:	
Chinese duty paid	$16.00
Domestic Scheelite	$16.00
Vanadium Ore, per lb. of contained V_2O_5	27½c.
Zinc Ore, Prime, 60 per cent concentrate, Joplin, Mo.; per ton.	$39.00

METALLIC COMPOUNDS

Arsenious Oxide (arsenic) lb.	3c.
Cobalt Oxide, 70@71 per cent, lb.	$1.41@$1.51
Copper Sulphate, 100 lb.	$4.85
Sodium Nitrate, ex vessel, in 200-lb. bags, per 100 lb.	$1.34
Sodium Sulphate, bulk, ton	$13.00@$15.00

ALLOYS

Beryllium-Copper, Master alloy, 2.5 to 3 per cent Be, per lb. of contained Be	$23.00
Ferrochrome, 65@70 per cent chromium, 4@6 per cent carbon, lb.	10c.
Ferromanganese, 78@82 per cent, gross ton	$80.00
Ferromolybdenum, 50@60 per cent Mo, lb. of Mo contained.	95c.
Ferrosilicon, 50 per cent, gross ton	$69.50
Ferrotungsten, 75@80 per cent, lb. of W contained	$1.30@$1.40

NON-METALLIC MINERALS

Asbestos, f.o.b. mines ton:	
Canadian (Quebec)	
Crude No. 1	$550@.....
Crude No. 2	$200@$225
Spinning fibers	$90@$150
Paper stock	$32.50@$37.50
Shorts	$11@$14.50
Vermont	
Shingle stock	$47.50.....
Paper stock	$35@.....
Cement stock	$23@.....
Barytes, long ton:	
Georgia, crude	$7.00
Missouri, 95 per cent $BaSO_4$, less than 1 per cent iron	$5.50
Bauxite, long ton:	
Domestic, chemical, 55@58 per cent	$6@ $7.50
Domestic, abrasive, 78@84 per cent	$12.50@$15.00
Dalmatian, 50@55 per cent	(a)$5.50@ $7.00
French, 56@59 per cent	(a)$6.50@ 7.50
China Clay, f.o.b. mines, ton:	
South Carolina and Georgia, bulk	$6.50@ $9.00
Delaware, No. 1	$14.00@.....
Feldspar, bulk, ton:	
Potash feldspar, 200 mesh	$17.00
Glass-spar, white, 20 mesh	$11.75
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois 85-5 per cent, all rail movement, ton	$18.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00@$14.00
Magnesite, per ton:	
Dead-burned, f.o.b. California	$25.00@.....
Dead-burned, f.o.b. Washington	$24.00@.....
Mica, per lb., North Carolina, No. 1 and 2 quality:	
1½ x 2 in.	15@30c.
2 x 2 in.	30@50c.
3 x 3 in.	75@$1.00
3 x 4 in.	$1.00@$1.25
4 x 6 in.	$2.00@$2.50
White, ground, 70 mesh, ton	$60.00@$80.00
Ocher, Georgia, ton	$19.00@$22.50
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports	(a)12@12½c.
Silica, water-floated, in bags, 325 mesh, ton	$16.00@$40.00
Sulphur, Texas mines, long ton	$18.00@.....
Talc, f.o.b. works, ton:	
New York, double air-floated, 325 mesh	$12.00@$15.00
New Jersey, mineral pulp	$8.00@$10.00
Vermont, extra white, 200 mesh	$8.50@ $9.00
Tripoli, Missouri, ton:	
40 mesh, cream colored	$15.00@.....
200 mesh, cream colored	$25.00@.....

(a) Nominal.

IRON AND STEEL

Pig Iron, Valley furnaces, gross ton:	
Bessemer	$21.50
Basic	$20.50
No. 2 Foundry	$21.00
Steel, base prices, Pittsburgh:	
Billets, gross ton	$34.00
Structural shapes, 100 lb.	$2.05
Bars, 100 lb.	$2.20

Monthly and Yearly

AVERAGE PRICES

SILVER AND STERLING EXCHANGE

	New York		London Spot		Sterling Exchange	
	1936	1937	1936	1937	1936	1937
January	47.250	44.913	20.250	20.734	496.115	490.670
February	44.750	.....	19.796	.....	499.908	.....
March	44.750	.....	19.663	.....	496.952	.....
April	44.892	.....	20.245	.....	494.139	.....
May	44.869	.....	20.248	.....	496.850	.....
June	44.750	.....	19.770	.....	501.817	.....
July	44.750	.....	19.590	.....	502.178	.....
August	44.750	.....	19.490	.....	502.519	.....
September	44.750	.....	19.579	.....	503.455	.....
October	44.750	.....	19.977	.....	489.755	.....
November	45.431	.....	21.050	.....	488.727	.....
December	45.352	.....	21.238	.....	490.670	.....
Year	45.087	.....	20.075	.....	496.924	.....

New York quotations for silver not eligible for sale to U. S. Government, cents per ounce troy, 999 fine. London, pence per ounce sterling silver 925 fine. Sterling exchange in cents.

COPPER

	F.O.B. Refinery, Electrolytic				London Spot (a)			
	Domestic		Export		Standard		Electrolytic	
	1936	1937	1936	1937	1936	1937	1936	1937
January	9.025	12.415	8.358	12.112	34.706	51.497	38.788	56.497
February	9.025	.....	8.566	.....	35.313	.....	39.463	.....
March	9.025	.....	8.708	.....	36.040	.....	40.227	.....
April	9.169	.....	8.849	.....	36.975	.....	41.131	.....
May	9.275	.....	8.819	.....	36.690	.....	40.839	.....
June	9.275	.....	8.790	.....	36.324	.....	40.357	.....
July	9.352	.....	8.993	.....	37.217	.....	41.228	.....
August	9.525	.....	9.297	.....	38.259	.....	42.375	.....
September	9.525	.....	9.523	.....	38.915	.....	43.267	.....
October	9.563	.....	9.669	.....	40.980	.....	45.295	.....
November	10.161	.....	10.349	.....	43.932	.....	48.467	.....
December	10.763	.....	10.835	.....	45.946	.....	50.364	.....
Year	9.474	.....	9.230	.....	38.441	.....	42.650	.....

New York quotations, cents per pound. London, pounds sterling per long ton, (a) Bid quotation.

LEAD

	New York		St. Louis		London			
	1936	1937	1936	1937	1936 Spot	1936 3 Mos.	1937 Spot	1937 3 Mos.
January	4.500	6.000	4.350	5.850	15.397	15.494	27.272	27.150
February	4.515	.....	4.365	.....	16.022	16.141	.....	.....
March	4.600	.....	4.450	.....	16.608	16.767	.....	.....
April	4.600	.....	4.450	.....	16.097	16.234	.....	.....
May	4.600	.....	4.450	.....	15.530	15.601	.....	.....
June	4.600	.....	4.450	.....	15.170	15.259	.....	.....
July	4.600	.....	4.450	.....	15.856	15.954	.....	.....
August	4.600	.....	4.450	.....	16.772	16.859	.....	.....
September	4.600	.....	4.450	.....	18.009	17.974	.....	.....
October	4.631	.....	4.488	.....	18.446	18.375	.....	.....
November	5.114	.....	4.964	.....	21.723	21.693	.....	.....
December	5.554	.....	5.406	.....	25.560	25.503	.....	.....
Year	4.710	.....	4.560	.....	17.599	17.655	.....	.....

New York and St. Louis quotations, cents per pound. London pounds sterling per long ton.

TIN

	Straits, New York		Standard, Spot, London	
	1936	1937	1936	1937
January	47.234	50.925	209.731	229.350
February	47.962	.....	207.081	.....
March	48.037	.....	213.080	.....
April	46.963	.....	209.313	.....
May	46.352	.....	202.429	.....
June	42.204	.....	183.167	.....
July	43.021	.....	185.957	.....
August	42.579	.....	183.731	.....
September	44.754	.....	194.676	.....
October	44.975	.....	201.193	.....
November	51.392	.....	230.869	.....
December	51.823	.....	232.108	.....
Year	46.441	.....	204.445	.....

New York quotations, cents per pound. London, pounds sterling per long ton.

ZINC

	St. Louis		London			
	1936	1937	1936 Spot	1936 3 Mos.	1937 Spot	1937 3 Mos.
January	4.848	5.847	14.488	14.719	21.153	21.281
February	4.859	.....	15.125	15.391	.....	.....
March	4.900	.....	15.983	16.190	.....	.....
April	4.900	.....	15.181	15.334	.....	.....
May	4.900	.....	14.536	14.777	.....	.....
June	4.880	.....	13.896	14.122	.....	.....
July	4.783	.....	13.579	13.826	.....	.....
August	4.800	.....	13.528	13.759	.....	.....
September	4.850	.....	13.906	14.159	.....	.....
October	4.850	.....	14.554	14.835	.....	.....
November	4.974	.....	16.301	16.554	.....	.....
December	5.273	.....	17.957	18.145	.....	.....
Year	4.901	.....	14.920	15.151	.....	.....

St. Louis quotations, cents per pound. London, pounds sterling per long ton.

CADMIUM AND ALUMINUM

	Cadmium		Aluminum	
	1936	1937	1936	1937
January	105.000	90.000	20.000	19.500
February	105.000	.....	20.000	.....
March	105.000	.....	20.000	.....
April	105.000	.....	20.000	.....
May	105.000	.....	20.000	.....
June	105.000	.....	20.000	.....
July	93.462	.....	20.000	.....
August	90.000	.....	20.000	.....
September	90.000	.....	20.000	.....
October	90.000	.....	20.000	.....
November	90.000	.....	20.000	.....
December	90.000	.....	20.000	.....
Year	97.789	.....	20.000	.....

Aluminum in cents per pound, 99 per cent grade. Cadmium, cents per pound.

ANTIMONY, QUICKSILVER, AND PLATINUM

	Antimony (a) New York		Quicksilver (b) New York		Platinum (c) New York	
	1936	1937	1936	1937	1936	1937
January	12.736	14.130	76.769	90.250	36.885	50.400
February	12.967	.....	77.000	.....	35.000	.....
March	13.072	.....	77.000	.....	34.115	.....
April	12.673	.....	76.731	.....	32.846	.....
May	12.410	.....	74.940	.....	32.000	.....
June	11.707	.....	74.192	.....	36.346	.....
July	11.245	.....	73.423	.....	39.308	.....
August	11.125	.....	73.923	.....	49.577	.....
September	11.740	.....	85.280	.....	68.960	.....
October	12.058	.....	89.240	.....	54.074	.....
November	12.233	.....	90.250	.....	48.000	.....
December	12.918	.....	90.250	.....	48.000	.....
Year	12.240	.....	79.917	.....	42.926	.....

(a) Antimony quotations in cents per pound, for ordinary brands. (b) Quicksilver in dollars per flask of 76 lb. (c) Platinum in dollars per ounce troy.

PIG IRON

	Bessemer		Basic		No. 2 Foundry	
	1936	1937	1936	1937	1936	1937
January	20.00	21.50	19.00	20.50	19.50	21.00
February	20.00	.....	19.00	.....	19.50	.....
March	20.00	.....	19.00	.....	19.50	.....
April	20.00	.....	19.00	.....	19.50	.....
May	20.00	.....	19.00	.....	19.50	.....
June	20.00	.....	19.00	.....	19.50	.....
July	20.00	.....	19.00	.....	19.50	.....
August	20.00	.....	19.00	.....	19.50	.....
September	20.00	.....	19.00	.....	19.50	.....
October	20.00	.....	19.00	.....	19.50	.....
November	20.23	.....	19.23	.....	19.73	.....
December	21.00	.....	20.00	.....	20.50	.....
Year	20.103	.....	19.103	.....	19.603	.....

Iron in dollars per long ton. F. o. b. Mahoning and Shenango Valley furnaces